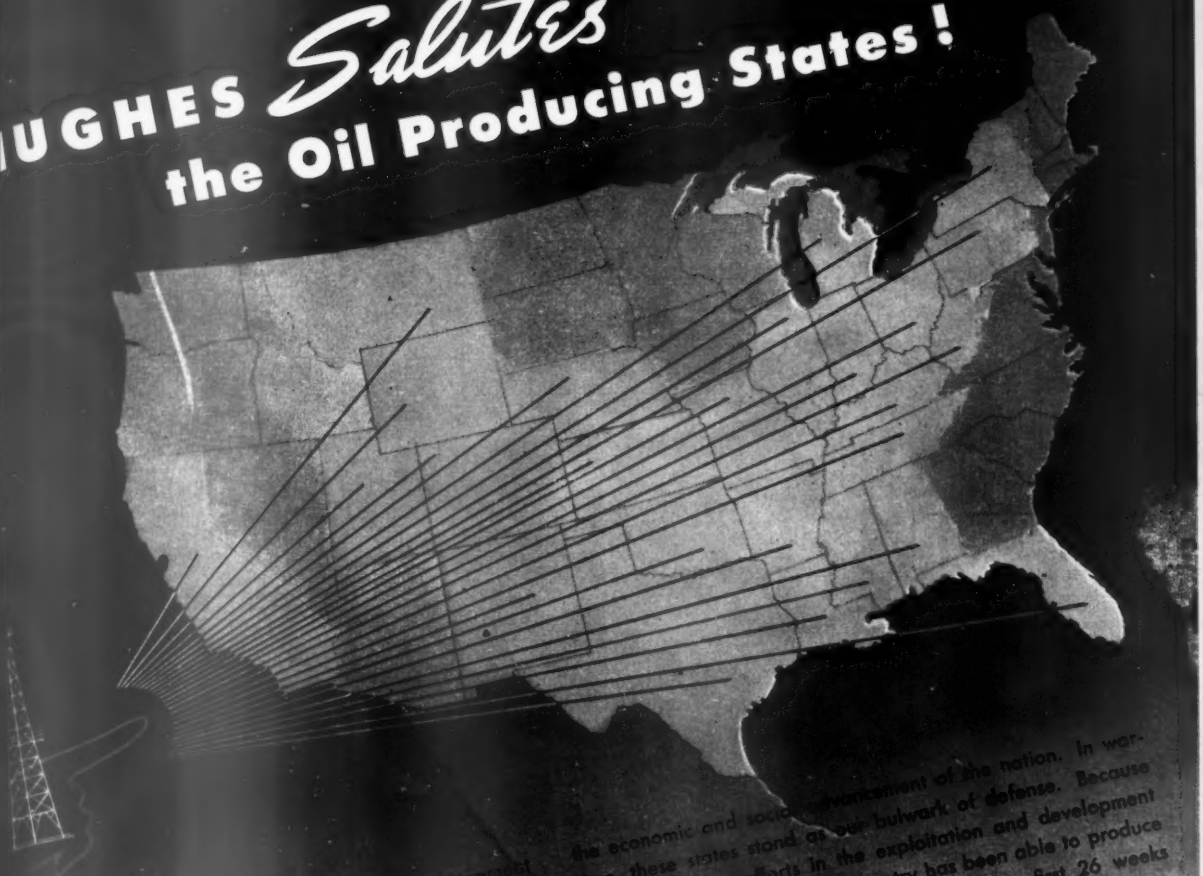
the OIL AND GAS JOURNAL

HUGHES Salutes the Oil Producing States!



...ory of oil in this war is one of outstanding achievement ... the economic and social advancement of the nation. In war-...American Oil Industry in going all-out for Victory, to ... time, these states stand as our bulwark of defense. Because ...to a story of the awakening of the American people to ... of their untiring efforts in the exploitation and development ...importance of petroleum products in their way of living. ... of this natural resource, this country has been able to produce ...ughout the modern history of our nation, oil has opened ... 809,400,550 barrels of crude oil during the first 26 weeks ...e door of opportunity for those seeking to provide more and ... of 1944.

...tter things for more people . . . and, today, due to the ... It is both fitting and timely to pay tribute to the oil producing ...constant research of the Industry's technologists, miracles are ... states of America for their part in the preservation of freedom ...being wrought from this wonder fluid that spell defeat for ... . . . and with each salute goes our pledge to continue pro-...the enemies of Freedom. ... viding the finest in specialized drilling equipment to meet the ...In peacetime, the oil-producing states of America pioneer ... Industry's requirements.

HUGHES TOOL COMPANY

HOUSTON TEXAS

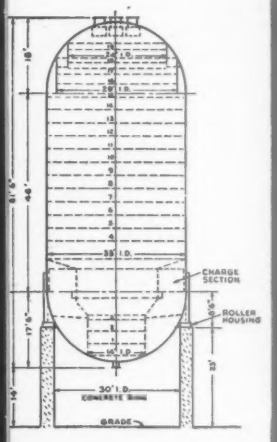
PRICE 20 CENTS

SEPTEMBER 9, 1944

GIANT 33-ft. DIAMETER

VACUUM FRACTIONATING TOWER

. . . fabricated at one of our plants and field-erected at an oil refinery.



The diagram below shows the arrangement of the bubble trays in the vacuum tower.

TAKING its place in the production line at one of the nation's leading refineries, this huge refinery vessel is destined to play an important role in the production of vital materials.

From an engineering standpoint this vessel incorporates many impressive features. It was designed to operate at a range of from 15 lbs. per sq. in. vacuum to 30 lbs. per sq. in. pressure and was installed to provide a vacuum stage for a crude still. It has an operating capacity of 37,000 bbls. per day. The 81 ft. 6 in. height of the tower is based upon the need for twelve 33-ft. diam. bubble trays and seven of smaller diam. in the top and bottom of the vessel to produce the different products desired, principally various grades of lubricating oils.

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As One Oil Man to Another . . .

HOW IS YOUR "I.D."?

(Every day more progressive operators are using the Baker Rotary Casing Scraper to make the inside or "working surface" of their casing clean, smooth and full diameter so that future work will be easy and safe to do.)

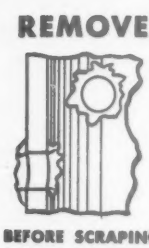
AN OPERATOR SAYS:
"We don't consider a well is complete until the casing is scraped smooth and clean."

ANOTHER USER SAYS:
"By running the scraper while the equipment is up and the crew is on hand, we leave the casing in smooth, clean condition for future work."

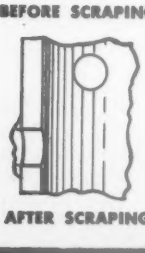
CASING SCRAPER

BAKER OIL TOOLS INC. — BAKER — SERVING THE WORLD

REMOVES BURRS LEFT AFTER GUN PERFORATING



BEFORE SCRAPING



AFTER SCRAPING

RESULTS The sharp burrs left after gun perforating are entirely and easily removed by the Baker Rotary Casing Scraper. Operators figure that the Casing Scraper rental is more than paid for by savings on swab and packer rubbers, and by the elimination of time lost through re-running damaged packers.

CLEANS OUT ALL CEMENT & SCALE

BEFORE SCRAPING

AFTER SCRAPING

RESULTS When running the bit to drill out cement, just make up the Baker Rotary Casing Scraper in the string. The scraper blades clean casing to its FULL I. D.

FOR RENT In all Domestic Oil Fields

BAKER OIL TOOLS, INC.

the OIL AND GAS JOURNAL

Trends

Crude-Oil Production
By States—Page 108

CRUDE-OIL STOCKS 222,931,000 bbl. as of August 26—down 109,000 bbl. One year ago 236,170,000 bbl.

GASOLINE STOCKS 80,740,000 bbl. as of August 26—down 737,000 bbl. One year ago 71,636,000 bbl.

RESIDUAL FUEL-OIL STOCKS 59,339,000 bbl. as of August 26—up 602,000 bbl. Year ago 66,724,000 bbl.

GAS OIL AND DISTILLATE STOCKS 41,543,000 bbl. as of August 26—up 1,235,000 bbl. One year ago 36,410,000 bbl.

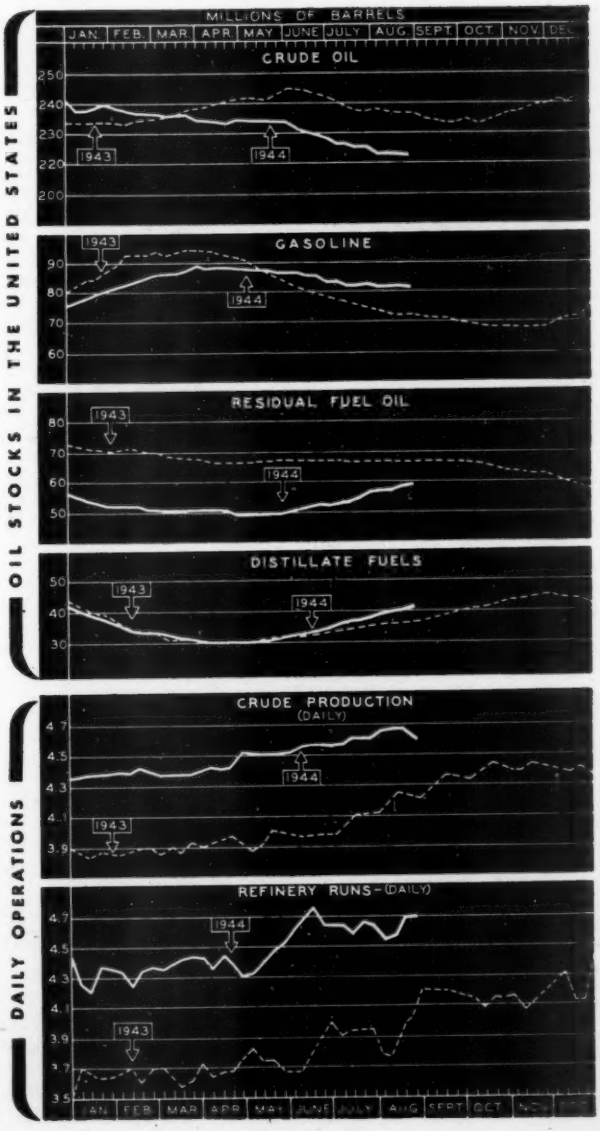
CRUDE-OIL PRODUCTION 4,648,800 bbl. as of September 2—down 24,250 bbl. Year ago 4,244,850 bbl.

REFINERY RUNS 4,698,000 bbl. daily week ended August 26—up 4,000 bbl. Year ago 4,277,000 bbl.

IN the two previous issues this page discussed the petroleum importance of the acquisition by the Allies of refineries in France and crude-oil production and refineries in Romania. To these important properties can now be added seven small refineries in Belgium and several terminal properties. It seems certain that the modern refinery of the Shell at Rotterdam, Netherlands, one of the newest plants in Europe, will also be under Allied control in the immediate future. This plant has a capacity of 15,000 bbl. daily. No announcement has been made by Allied military leaders regarding the condition of these plants.

ECONOMISTS of the petroleum industry are also discussing what the petroleum requirements of the countries now being freed from German control will be and how these needs will be supplied. The yearly surveys of petroleum demands by countries of Garfias, Whetsel and Ristori, of Cities Service Co., cover the prewar petroleum consumption of these countries. For 1938 this report gives the following consumption data in 42-gal. barrels; France, 54,000,000; Italy, 21,000,000; Romania, 14,450,000; Netherlands, 10,950,000; Belgium, 6,700,000; Denmark, 6,550,000; Norway, 4,850,000; Poland, 3,350,000; Czechoslovakia, 2,220,000; Finland, 1,970,000; Hungary, 1,960,000; Austria, 2,720,000. These yearly figures total 130,720,000 bbl., or 358,000 bbl. daily. The 1938 report credited Germany with a petroleum consumption, which did not include all of the demands for synthetics, of 53,000,000 bbl., or 145,000 bbl. daily.

WHILE there are no accurate reports available showing what these invaded and warring countries have consumed since 1940, it is certain that the total is less than half of the prewar requirements, with no civilian consumption except those contributing directly to war production. In the rehabilitation period it has been assumed by some economists that the petroleum demands of these countries, exclusive of Germany, will be as large as those immediately preceding the start of the war. It has also been assumed that most of the countries concerned would have the support of the United States and Great Britain in arranging for the purchase of these petroleum requirements including the materials needed for rebuilding of any properties that have been destroyed during the war period.



Series of Practical Problems Besets Operation of Subsidy

A WHOLE series of practical problems are arising from the stripper-well subsidy plan by which oil producers in fields yielding less than 9 bbl. per well per day receive premiums ranging from 20 to 75 cents per barrel through Defense Supplies Corp. Most of the questions are confined to fields which are eligible for subsidy payments ranging up to 35 cents because the 75-cent premium applies universally to fields producing Pennsylvania Grade crude oil, eliminating details of pool and county designations by OPA.

Most of the problems are matters of detail, which if not snarled by legal technicalities, can be ironed out without too much trouble. However, some oil men, familiar with the numerous legal restrictions that surround the expenditure of government funds, are not too hopeful that these details can be solved as simply and easily as appearances would indicate.

The current practical problem is that of handling production from wells and leases that are not within the boundaries of "eligible" pools. In many cases field limits recorded by state bodies or as compiled by the OPA, are inaccurate and incomplete.

County Lines Troublesome

Still another phase of this same problem is represented by pools listed by the OPA by name and county. Frequently these pools overlap county lines. Thus the Bird Creek pool of Tulsa County, Oklahoma, is in the eligible list, but actually part of the pool overlaps into Osage County. What is the status of payments to Osage County producers in the Bird Creek pool? The Keystone pool is on the eligible list for Pawnee County, but there are also Keystone leases across the line in Creek and Tulsa counties. Is it safe to pay the subsidy to the Keystone producers in Creek and Tulsa counties?

All such questions are submitted to state certifying bodies. Purchasers seek certification that the particular lease is actually in the eligible pool. Most of them will probably pay the subsidy on purchases from such leases and trust that OPA and DSC will modify their definition of the pool and make it retroactive.

The major problem is presented by leases that do not clearly lie within the accepted boundaries of any pool on the eligible list. There are many scattered wells, sometimes in small groups, that never have been assigned pool names, usually because the production was unimportant. There is a provision in the regulations that will permit the OPA to take care of this situation. The question is how this provision will be administered.

A sample form listing the data required for action on such an appeal, with the form being flexible enough to permit substitution of approximate equivalent information when the type called for on the form is not readily available, would aid greatly in solving this problem. Furthermore, all parties concerned would be saved time if OPA would indicate exactly what type of certification must be attached to such information.

"First Purchaser" Interpretation

The larger purchasing companies are not in complete agreement on the method of handling 100 per cent division orders. Some of them are paying the subsidy to the company to which pipe-line-run payments are made, on the basis that the purchasing company is the "first purchaser" under the regulations. Other large purchasing companies are not paying the subsidy themselves, but assume that the company receiving payments for crude under the 100 per cent division order is the "first purchaser" under the regulations. In most cases this will not affect the small producer or the royalty owner, being simply a matter of legal interpretation among the larger companies, the OPA and DSC as to who should make the payments.

Purchasing companies report occasional cases of confusion among producers where there are two or more pools of the same name, but where one has the additional name East, West, North, etc. In some cases one pool is eligible and the other is not, such as Payne County, Oklahoma, where the Tuskegee pool, averaging 1 bbl. per well per day is eligible and named, but Tuskegee East pool, averaging 12 bbl. per well per day is not.

There is an apparent loophole in the regulations, which will probably be plugged soon, in that certain counties are listed as eligible, "except" certain named pools. Opinion is that newly discovered pools after August 1 in such counties can claim subsidy, regardless of production rate per well, until specifically excepted by OPA. If such cases arise before the regulations are amended, the purchasing companies would probably exercise their option to refuse subsidy payment.

There are some problems, probably not of general application, but which are vitally important to the producers involved. There are cases where, in the absence of a pipe-line gathering system, oil is gathered by truckers and hauled to a refinery. In some cases these truckers are not financially able to pay the subsidy and wait on reimbursement by DSC. There are also cases where the crude oil is not refined, but is purchased by some concern which uses it directly, or resells it to an ultimate consumer. There have been cases like this where the purchaser refused to pay the subsidy.

Multiple-Pay Problem

Another problem now facing OPA is that of fields with several horizons, some of which are in the stripper class while others are flush. Where wells are dual completed there is no possible way of segregating oil from the various horizons, so the average production per well, regardless of its producing horizon, probably will be taken as determining the rate of premium, if any. Where wells in a single field are not dual completed but tap two or more horizons, OPA will treat each pool separately if the oil is kept separate as it is produced and is sold from separate lease tanks. In such cases oil from one horizon might be eligible for a premium price while that from another level of the same field might not be. Where oil from multiple-zone fields is not segregated as it is produced OPA probably will base its action on a weighted average production per well for the entire field unless producers can show some basis for segregation that is administratively feasible.

First purchasers of crude from stripper pools have been annoyed at the delay of the Defense Supplies Corp. in distributing report forms for making claims for payment of the subsidy. These forms were mailed out only this week, although purchasers normally pay for August production the first few days of September and some make payments two or three times a month. Claims for subsidy may not be filed until after payment has been made to producers, but many purchasers desired to have the official forms in advance so that their accounting departments could become familiar with them. The DSC forms in general call for information that is already in the records of most crude purchasers, and officials declare that purchasers should have little difficulty filling out these forms once the original DSC request for basic data on production by leases has been compiled.

Texas Co. Completes $21,000,000 Plant at Los Angeles Refinery

LOS ANGELES. — An expansion program completed on August 31 at the Los Angeles refinery of The Texas Co. at Wilmington, Calif., involving an expenditure of approximately $21,000,000, will increase the company's facilities for meeting military demands for petroleum products.

Prior to Pearl Harbor, this refinery was operating at a charge rate of 30,000 bbl. of crude oil per day, producing 2,000 bbl. of 100-octane aviation gasoline, various grades of civilian gasolines, kerosene, stove oil, diesel oils as well as U. S. Navy special grade fuel oil and several grades of civilian fuel oils.

Immediately after Pearl Harbor, The Texas Co. started consideration of facilities at its Los Angeles works for the manufacture of additional military products. The principal objective of these new operating facilities was to increase the production of 100-octane aviation gasoline and other grades of gasoline required by the military for the successful prosecution of the war.

To accomplish this purpose, it was necessary to provide: (a) Additional crude stilling capacity; (b) additional fractionating capacity for straight-run naphthas and natural gasolines; (c) a new fluid catalytic cracking unit for the production of additional olefins and isobutane, to be utilized in the manufacture of alkylate, and for the production of isopentane and base naphtha fractions, all to be used in the manufacture of 100-octane gasoline; (d) a new plant for the production of alkylate, including a new feed-preparation unit for the improvement of alkylation-plant charge; (e) installation of new tankage, and (f) additional steam-generating facilities, new water well and cooling towers.

Crude Stills

The new crude-still unit, capable of running 12,500 bbl. per day of 36-42 A.P.I. gravity crude oil, has been completed and is in operation. This unit consists of a pipe-still furnace, a 11 by 120-ft. fractionating tower; two 4 by 11 ft. 6-in. stripping towers together with the required pumps, lines, condensers, coolers, and other necessary auxiliary equipment for efficient operation. This unit will produce straightrun naphtha of any desired endpoint, kerosene distillate, gas oil and a straight-run fuel residuum of 250 to 300 Saybolt Furol viscosity at 122° F.

This crude unit was so designed as to permit the refractionation of 7,500 bbl. per day of 375° F. straight-run naphtha produced on other crude still units at this plant, which operating procedure is rather novel and unusual, and which eliminates the necessity of a separate rerun unit for such purposes.

Superfractionator

This equipment was designed for the processing of 15,000 bbl. per day of combined charge made up of depropanized natural gasoline, straight-run naphtha, vapor recovery compressor gasoline and any pentane and lighter fractions from the No. 1 and No. 2 alkylation-plant operations.

There are six fractionating towers operating in this unit. The first column debutanizes the charge, fractionating off an isobutane - n-butane fraction which goes to the No. 2 alkylation plant for further processing. The second column dependentanizes the debutanized stock; the third column splits the pentanes fraction into isopentane and normal pentane. The fourth, fifth and sixth columns produce as overhead products respectively a hexanes-isoheptane cut, an n-heptane cut, and an isooctane cut. Bottoms from the sixth tower are n-octane and heavier. The respective products are segregated for use to the best advantage in military aviation products, motor gasoline, and for further processing.

The dimensions of the columns are as follows: Debutanizer, 6 ft. 6 in. by 67 ft. 8 in.; dependentanizer, 6 by 129 ft.; deisopentanizer, 8 by 162 ft.; deisoheptanizer, 9 by 160 ft. 6 in.; deheptanizer, 7 by 163 ft.; and deisooctanizer, 6 by 145 ft.

Fluid Catalytic Cracking Unit

A new unit for the production of certain desired hydrocarbon fractions by the use of catalytic cracking was installed. This unit consists of a reactor, a regenerator, a precipitator, a bubble tower and fractionating equipment. This operation consists of contacting the charge with a powdered synthetic catalyst at temperatures between 950° F. and 1,050° F., dependent upon the final products desired.

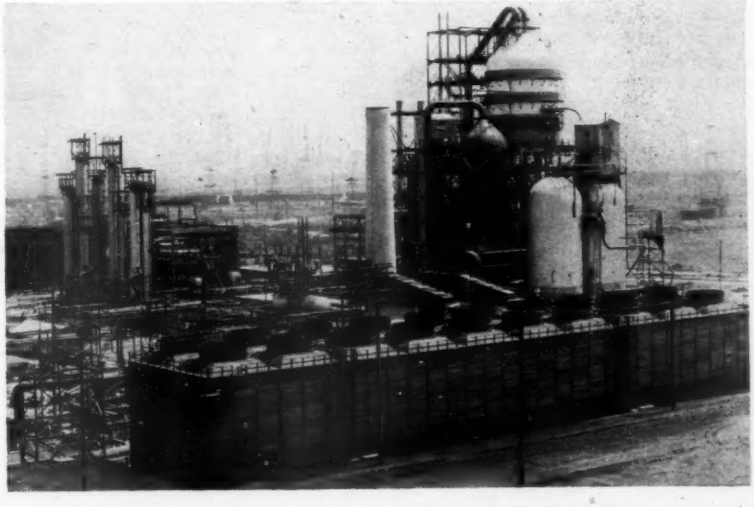
After the reaction between the catalyst and the oil charge, which is a distillate having a distillation range between 375° to 900° F., the vapors are cooled and go to the fractionating side of this unit where the catalytic distillate is depropanized and split into butylenes, pentylenes, C_6 - 185° F. and fractions boiling between 185° to 210° F.; 210° to 300° F.; 300° to 400° F. as well as light and heavy cycle gas oils. These products are delivered to storage for further processing at the alkylation units, treating plants, and other operating department.

This fluid catalytic cracking operation is unique in its mechanical control apparatus. More than 500 control instruments are in use on this unit.

Feed-Preparation Unit

The new feed-preparation unit is used to improve the quality of both the thermal and catalytic olefins prior to their use at the alkylation units.

A caustic wash is given the thermal butylenes for mercaptan removal and a weak-acid treatment is



Fluid catalytic cracking unit with fractionating section in left background. Induced draft cooling tower in foreground has capacity of 30,000 gal. per minute

given the thermal pentylene for removal of diolefins. A rerun operation is provided for the removal of any polymers which might be produced in the weak-acid treating operations.

The catalytic butylenes are given no treatment. The catalytic pentylenes are caustic washed for mercaptan removal and also are given a weak-acid treat for diolefin removal with a resultant rerun for removal of polymers.

The following columns are included in the feed-preparation unit: A 3 ft. and 5 ft. by 88 ft. 6 in. primary depropanizer, 2 by 38 ft. thermal olefin and 3 ft. 6 in. by 42 ft. catalytic pentylene caustic washers, a 3 by 26 ft. caustic regenerator, a 3 ft. and 4 ft. by 76 ft. primary debutanizer, and a 3 by 41 ft. 6 in. rerun tower.

The new alkylation plant facilities consist of the necessary fractionating towers, acid contactors, neutralizing equipment and rerun stills to permit the combination of olefinic butylenes (C_4) and pentylenes (C_5) with isobutane to produce alkylate which is the base for the manufacture of 100-octane aviation gasoline. During this process depropanization, deisobutanization, and debutanization of either the charge or the resultant products take place as well as a final rerun operation to eliminate the polymers produced in the alkylation process.

The equipment in the new alkylation unit consists of four Stratco Type 50 contactors, an 8 by 128 ft. product debutanizer, a 10 by 162 ft. 6 in. deisobutanizer, a 6 by 87 ft. depropanizer, and a 7 by 63 ft. final fractionator.

As a result of this new equipment The Texas Co. can process 42,500 bbl. per day of crude oil, can produce more than 12,500 bbl. per day of aviation gasolines, of which more than 10,500 bbl. daily is 100-octane fuel, can produce 2,000 bbl. of additional military gasolines other than aviation grades as well as supply its essential civilian demands.

J. H. Marshall Resigns as Chief Counsel for PAW

WASHINGTON.—J. Howard Marshall has resigned as chief counsel for Petroleum Administration for War and assistant petroleum administrator. The resignation was effective September 1. Marshall said he planned to return to his home in San Francisco and to resume his law practice with the firm of Pillsbury, Madison & Sutro. Robert E. Hardwicke, assistant chief counsel, will succeed him, it was said.

In 1941, shortly after Office of Petroleum Coordinator was established, Marshall came to Washington as its chief counsel and he remained when it became PAW. Several years before, in the National Recovery Administration days, he was a member of the Petroleum Administrative Board and was its counsel.

Stanolind Buys Carl King Holdings in Ector County

FORT WORTH.—Stanolind Oil & Gas Co. has closed negotiations for purchase of the Carl B. King holdings in the North Cowden field of northern Ector County. The company has taken over operation of the properties, which include 10 wells and about 560 acres of land. The consideration was $600,000.

Stanolind reported it had closed a deal for 21,000 acres of the G. W. Connell ranch in eastern Garza County. The consideration is reported to have been approximately $3 an acre, with 50-cent rental for 10-year commercial leases.

Engineers Say East Texas Needs More Key Wells

AUSTIN.—The number of wells in the East Texas field tested regularly for bottom-hole pressure should be increased and other measures should be adopted to insure accuracy of averages obtained by the state Raliroad Commission, according to a committee of engineers who have made a study of conditions.

Col. E. O. Thompson, member of the commission, said the report made by J. K. Baumel, director of production for the commission, on a meeting held by the engineers at Kilgore, included the following summary of recommendations:

1. The number of key wells tested monthly by the commission to determine bottom-hole pressures should be increased from 92 to 100.
2. Quarterly averages should be taken from these wells and along with approximately 400 others tested regularly by private operators in the field, to reach the most comprehensive coverage possible.
3. Railroad Commission test wells which may require pumping or gas-lift apparatus should be retained as test wells, but their allowables should be transferred to other wells on the same lease.
4. Weighted average figures should be kept on bottom-hole pressure instead of straight mathematical averages. The weighted average would allow for divergence of acreage and other factors.

Baumel said the engineers think the commission should rearrange its key wells before the next survey, so a uniform pattern can be presented.

At the last state-wide proration hearing W. S. Morris, of the East Texas Salt Water Disposal Co., said the 6-lb. drop in East Texas reservoir energy indicated in June and July by the commission survey was greater than the decline measured by some operators in the field.

Agreement a "Milestone" in Federal-State Relations

WASHINGTON. — An agreement for oil prospecting on the public domain in New Mexico has received governmental approval, and William E. Wrather, director of U. S. Geological Survey, describes the step as an "important milestone" in federal-state relations with regard to natural resources. The pact, which is between the Interior Department and the State of New Mexico, permits Stanolind Oil & Gas Co. to prospect for oil in the 20,471-acre Picacho unit area, in Lincoln County.

About 52 per cent of the Picacho geological unit area is land in the public domain, and under the jurisdiction of the Interior Department. The rest is owned by the state and by private individuals.

In a unit area such as Picacho it is customary to wipe out property lines to the extent necessary for efficient engineering operations. On the Picacho unit the lessees of the public and state land and the individuals in control of the private land have contracted with Stanolind to do the work.

But work could not begin without an agreement between the state and federal governments on some coordinated system of controlling the unified engineering program.

Colombian Production Declines Slightly

Crude oil production in Colombia declined slightly in June when it totaled 1,916,800 bbl. against 2,085,000 bbl. in May. However, it remained in the vicinity of 65,000 bbl. per day which it has averaged in recent months, its highest sustained level since the abrupt decline in early 1942. The June daily average was 63,700 bbl. against 67,000 bbl. for May.

For the first half of this year Colombian production aggregated 10,834,998 bbl. against 3,561,442 bbl. in the same months of 1943, an increase of more than 200 per cent. Comparative figures for the two periods follow:

Month—	1944	1943
January	1,266,034	208,532
February	1,666,689	334,211
March	1,924,595	491,656
April	1,975,880	350,367
May	2,085,000	933,514
June	1,916,800	1,243,162
Total	10,834,998	3,561,442

THIS WEEK

PRODUCTION—West flank of Nemaha Ridge recaptures spotlight. . . . Carter Oil Co. wildcat assures production from Wilcox, scoring second success out of three tests, near Noble, Okla. . . . ¶California Co. starting two offsets to Mallalieu pool discovery in Lincoln County, Mississippi, presaging active development program. . . . ¶Railroad Commissioner E. O. Thompson warns Texas operators to be prepared for cut in production, when European war ends. . . . Reductions will apply first to fields exceeding optimum rate of withdrawal at existing forced-production rates. . . . ¶Congressional committee to investigate inability of Ohio Oil Co. to sell current allowable of Yates pool crude oil. . . .

EXPLORATION—Decline of wildcat completions since end of July reflects assignment of more rigs to development drilling, modified policy of major companies in supporting exploration. . . . ¶East Coast wildcat leasing play attracting new companies—quantity acreage, rather than quality, chief guide. . . .

PRICES—OPA decides against making future subsidy certifications retroactive. . . . Pools qualifying after September 1 will have date fixed for start of subsidy payments. . . . Separate pools in same field may qualify, if production is segregated and if well average is less than 9 bbl. daily. . . .

INTERNATIONAL—Mexico concentrating on settlement of British and Dutch claims hanging over from 1938 expropriation. . . . ¶Colombia's production holding near 65,000 bbl. per day, up 200 per cent for first 6 months. . . . ¶Time and scope of Senate hearings on British-American oil agreement not yet determined. . . . ¶Postwar imports and exports most perplexing unknowns in petroleum-industry projections. . . . Producers and refiners turning more thought to this problem without benefit of positive understanding on foreign policy. . . .

DEVELOPMENT—Consensus indicates West Edmond field will become 180,000,000-bbl. field, possibly largest discovery since Elk Basin. . . . Active rigs exceed 100 and more are to be moved in for developing 500 to 700 undrilled locations. . . . ¶California Co. starts active development of Rangely dome, a 1934 discovery, with results at second well indicating the field may become best in Colorado. . . . Tensleep proven productive at Gebo dome which previously produced only from Embar. . . .

REFINING—The Texas Co. completes $21,000,000 war plant at Los Angeles refinery. . . . Facilities capable of producing more than 10,500 bbl. of 100-octane gasoline daily. . . . ¶Improvement in crude-oil distribution in District 2 shown by substantial decline in sharing directive for September. . . .

TRANSPORTATION—Three pipe-line projects to move increased production from the Naval Reserve at Elk Hills approved by PAW. . . . ¶Ohio Oil Co. starting work this month on 115-mile 8-in. products line from Robinson, Ill., to Indianapolis, Ind., completion scheduled in October and November. . . .

Rolling oil drums through the surf onto the beach of Tinian Island from a Coast Guard tank lighter. Scores of such scenes will be repeated before the Pacific war is concluded. Oil supplies always follow immediately after the first few assault vehicles, re-emphasizing the indispensability of petroleum — in abundant quantities

Rich Ploesti Oil Fields Now in Allied Hands

LONDON.—Oil fields surrounding Ploesti, most important single source of petroleum for the German armies, are now firmly in Allied hands. Capture of this prize is regarded as the most significant victory of the Romanian campaign and as a disastrous blow for the Nazis.

The British Ministry of Economic Warfare estimated that Romania's great oil fields, of which Ploesti is the center, were capable of producing 5,500,000 metric tons of crude oil a year, although repeated Allied aerial attacks had reduced Ploesti's output of refined oil to 2,000,000 tons.

There are at least 16 refineries and oil-storage depots in the main Ploesti area and three in outlying districts amid the widespread 13 major oil fields, several of which were controlled in prewar days by American and British capital.

Reports from Ankara said the Germans had put the torch to refineries and oil wells that had supplied the German war machine with at least 55 per cent of needed mineral oil. Reliable estimates said Romania's oilfields produced at least one-third of the total natural and synthetic oil used by Germany.

The Reich's synthetic oil production has been greatly reduced by Allied bombing and the supplies of shale in Estonia are threatened by a Red Army drive in that Baltic country. Oil fields at Drogobych in Poland have fallen to the Russians.

Magnolia Posts Prices for Fullerton and Union

DALLAS. — Magnolia Petroleum Co. has posted the following prices for crude oil from the Fullerton and Union fields (Clear Fork formation, Permian system), in Andrews County, Texas: Below 20° gravity, 83 cents a barrel, with 2 cents differential for each degree of gravity, beginning at 85 cents for 20° to 20.9°, up to a top of $1.25 for crude of 40° gravity and above, based upon use of 100 per cent tank tables. The schedule is effective as of September 1.

Ohio Oil Sells Nebraska Producing Properties

Completion of sale and transfer of title of the Richardson County, Nebraska producing properties of the Ohio Oil Co. to a Tulsa syndicate was announced last week.

The purchasing group is composed of J. R. Watt, Tulsa Iron & Metal Co.; Meyer Moran, Moran Pipe & Supply Co.; A. M. Stekoll, Abe Stekoll Oil Co.; and William Ungerman, William Ungerman, Inc.

The seven leases comprising the Ohio Oil Co. properties are approximately 2 miles from Falls City and currently produce 400 bbl. of oil daily.

Kendall Refining Acquires Duke Center Properties

BRADFORD, Pa.—Kendall Refining Co. has purchased the producing oil properties of the W. F. Sprague estate at Duke Center, comprising 81 acres in fee, with 15 wells. Earlier this year Kendall took over the W. F. Grow farm of 229 acres with 54 producing wells, and a 10-acre tract owned by Naomi J. Lilly, both in the Duke Center area, on a royalty basis.

Phillips May Acquire Alberta Acreage

Officials of the Phillips Petroleum Co. of Bartlesville, Okla., are in Calgary discussing the acquisition of acreage held by Walter S. Campbell and a group of independent companies on the Sullivan Creek structure, in the Alberta foothills south and west of Turner Valley.

Letters:

"Having read with interest your editorial in the issue of August 26 headed 'A Timely Letter,' I would like to make a few comments:

"Those of us who have been familiar with the petroleum industry, especially during recent years, understand and are sympathetic with the constructive work of the commissions in the several large oil-producing states, They have done a wonderful job and have added tremendously to the petroleum reserves of the nation.

"It is well known that conditions vary greatly from one state to another. In fact, each oil field is somewhat different from every other field. The best results will be obtained by a study of the local conditions. The commissions with their staff of experienced engineers are best qualified to issue rules and regulations governing operations in each field. A centralized government, thousands of miles away, cannot be as efficient as state commissions. Untold millions of barrels of oil have been saved as a result of local hearings and decisions.

"Then came the terrible World War 2 and with it the formation of the Petroleum Administration for War—commonly called the PAW. The state regulatory bodies stepped aside and in the interest of winning the war, permitted PAW to supersede the state laws and regulations.

"The constantly increasing demand for petroleum and its products was met with a smile by every interested party, even though it was known that wells and fields were being injured because production was exceeding the maximum efficient rate.

"The principal justification for the operation of PAW, so far as the production of petroleum is concerned, was to control the allocation of so-called 'critical' material. This was of the utmost importance and the PAW is to be commended for the work it did. There is, however, very little need at this time for the red tape requirements in connection with material purchases.

"Commissioner Jester's (of Texas) letter to Secretary Ickes was very timely. There is no good reason why the secretary should not promptly accept the suggestions of the commissioner."

E. B. REESER.

" . . . It is true that PAW has been helpful in the correlation and coordination of the petroleum industry for the war effort.

"However, with the end of the European war in sight, any delay in proposals to return oil and gas regulations to state regulatory bodies might impair conditions within the industry. Moreover, it is high time to consider a rapid and expedient retrenchment program whereby many other unnecessary federal bureaus will be disbanded in the interest of our national economy."

H. E. ZOLLER,
President, The Derby Oil Co.

"I have been following closely your series of articles entitled Practical Refinery Engineering by Messrs. Buthod and Whiteley. The material is well presented and the charts extremely useful. Unfortunately, I have missed a few of the installments as a result of travel away from the vicinity and would like to bring myself up to date. For this reason and future reference I would like to request reprints of the separate articles or of the group when the series is completed."

A. S. GRUNDY,
Shell Development Co., San Francisco.

Editor's note.—The above is typical of the numerous favorable comments received regarding the "Heat Transfer" series, No. 12, of which starts on page 82 of this issue. Back issues containing this series are no longer available.

FOUNDED IN 1910

BY PATRICK C. BOYLE

the OIL AND GAS JOURNAL

New Demand Data Needed

THE petroleum industry is in need of complete information with which it can safely plan its course when the European war ends and later when the entire world returns to a peace economy. At present there is confusion. There are those who have been led to believe that when Germany capitulates, there will come overnight a contraction so severe that civilian markets will be flooded with excess supplies.

Other projections, coming from Washington, contend that civilian petroleum shortages will continue so that rationing will be necessary 6 to 12 months after all hostilities cease. These varying opinions reflect the lack of data covering future demands. Knowledge of the facts is just as essential now for intelligent postwar planning as it was 3 years ago for effective war preparations.

What is essential immediately is information on military requirements after the war is confined to the Pacific area. This involves disposition of large military storage in this country, Great Britain, North Africa and other points adjacent to the battle areas. It also includes production of rehabilitated fields and refineries of Romania; the increased output to be expected from old and new oil areas of the Middle East, and the requirements of the peoples of western Europe now being freed from German domination.

The need for secrecy in these and allied matters, at least so far as general operating programs are concerned, has passed.

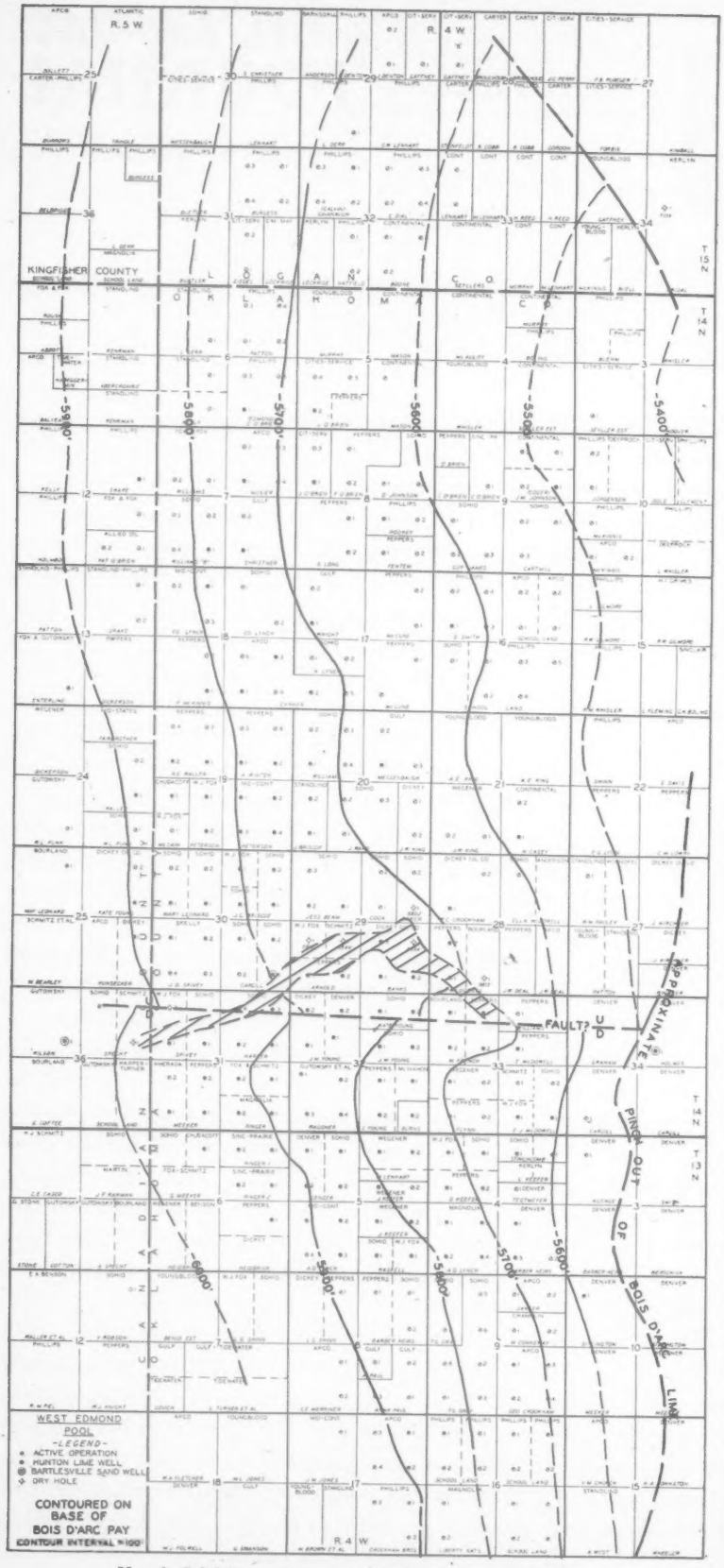
With the military demands known, accurate estimates of total petroleum requirements can be supplied to producers and refiners in this and other countries. The industry's principal economic committee, whose work still consists in making studies which assume that the German war will continue through 1945, should resume its pre-emergency function of advising the industry regarding all future demands.

If the oil business is advised quickly regarding the decreases in military consumption which appear to be assured in the light of recent Allied successes, there should be no fears as to the ability of operators to make the necessary adjustments in their activities later this year and in 1945. Any conversion program assumes a release from those governmental restrictions, whose justification ends when this country's economy is no longer geared solely to the production of war goods.

Unlike many war enterprises, the oil industry does not have to wait on the Government's reconversion program, including its plans yet to be formulated of disposing of war properties, to reduce its emergency operations and to expand those which will supply civilian outlets. The industry still has most of its prewar refining facilities, and these, plus the war units which can readily be redesigned, will take care of civilian consumption.

So far as supplies are concerned, some declines in production with the conclusion of the European conflict, are to be expected. They are desirable, so far as the present record output represents recoveries in excess of the maximum efficient rates of production and in some areas withdrawals from reserves which are not being replaced.

The remedy here is to give operators and state conservation bodies the green light, so that they will be in a position to reduce or extend operations as conditions justify. The balancing of future supplies and demands presents no greater problems than those of the past—certainly no more difficult than those which have been solved from month to month since Pearl Harbor.



Map 1: Solid lines actual data, broken lines approximate

WEST EDM ND Presents Par

180,000,000-Bbl. Field On Probable Reserves

by Charles J. Deegan

THE West Edmond field in Oklahoma appears to be one paradox after another. To begin with, although it is located in the heart of the oil field country and easily accessible, it is the subject of more speculation and less factual consideration than almost any remote and inaccessible field of the past decade. Although it now has more than 123 producing wells and is the scene of the largest concentration of rotary drilling rigs in the country, there is more skepticism about its potentialities than any field of like size in many years. Geologically, it is a simple stratigraphic trap, but there are many local peculiarities, which are the subject of considerable difference of opinion. Limits of the field can be approximately determined in a general east-west direction, which by the nature of the geology will be the width; its north and south boundaries seem to be wide open, and furthermore both north and south extensions, if any, can swing east or west at any time. Finally, it was discovered by an independent wildcatter, who claims to have determined the location by a "doodle-bug"; and the major companies were slow in deciding to buy into the field.

The basic reason for the general lack of knowledge and the widespread skepticism is the producing horizon, Hunton lime. The Hunton, speaking conservatively, has a mediocre reputation as an oil-producing formation, although it has produced oil in many places in Oklahoma. Consequently West Edmond has two strikes on it in oil men's score cards before they even investigate its potentialities. That is why so many of them are just now deciding to take the time to check into the situation; why others delayed so long before they moved in to make a play.

Two questions are generally asked by oil men about West Edmond. "Is it really a major pool?" and then "Will it pay out?" The answer is that it certainly has the areal scope of a major pool and a lot of smart

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ND FIELD

Paradox

Indicated by Consensus In 30,000-Acre Area

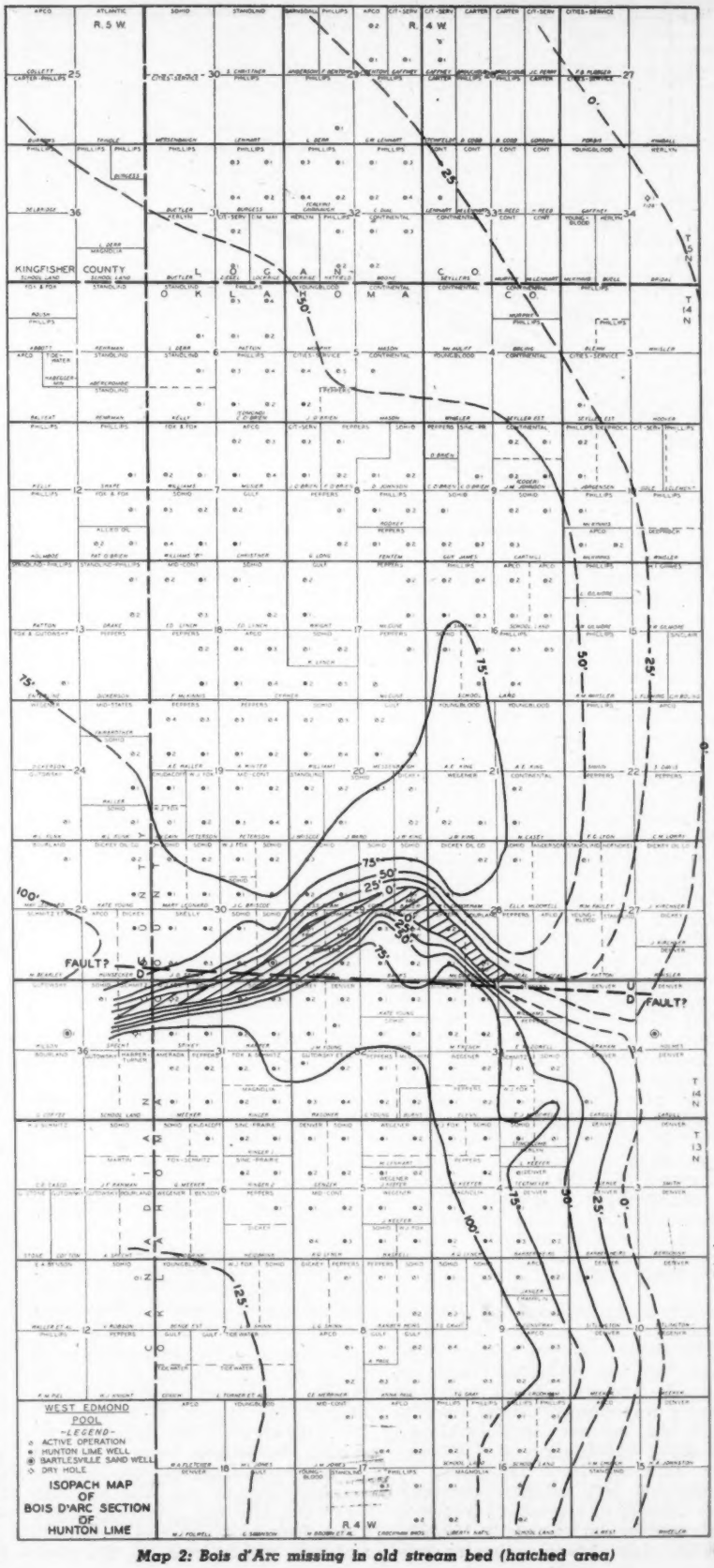
oil men are betting heavy investments that it will pay out.

Taking up the question of whether West Edmond is a major pool, this can be said. Over an area already a little over 9 miles long and about 3 miles wide, more than 123 producing wells have been completed, with most of them indicating an initial potential flow of 25 bbl. to 100 bbl. per hour. Estimates of the ultimate producing area, made by geologists and company officials familiar with the field range from about 25,000 to 33,000 acres. From May 1943 to September 1944 the field produced 3,470,000 bbl. As of September 1, 1944, it was producing 23,500 bbl. per day. There are more than 100 drilling rigs operating in the field with additional rigs being brought in or scheduled to be moved in from various parts of the country.

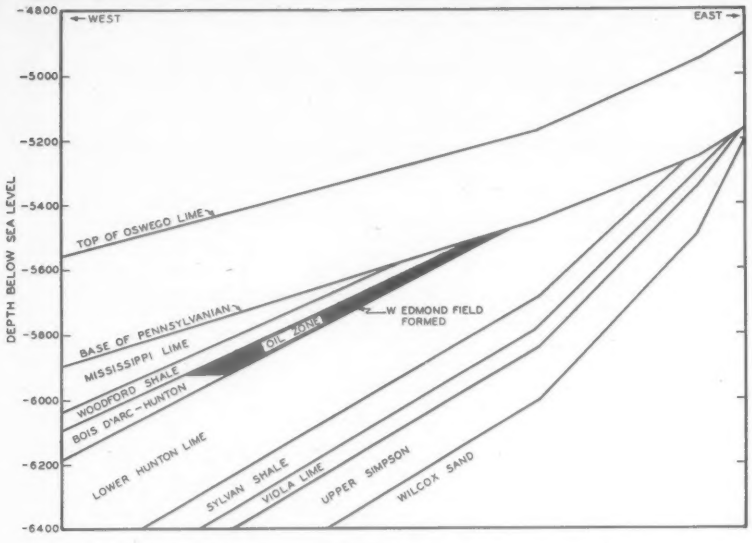
Since development is on 40-acre spacing, the wells now producing cover only about 5,000 acres of drainage area, leaving from 20,000 to 28,000 acres still to be drilled. On a 40-acre pattern, this means 500 to 700 undrilled locations, of which 100 to 110 now have rigs on them making hole. From the standpoint of the drilling contractors, there are four to five prospective wells per rig in the field, and since 7 weeks is a fair average drilling time, it looks like a minimum of 28 to 35 weeks assured work for each rig.

By all these criteria, West Edmond is a major field, but the real test is how much oil will be produced. Here is where the reputation of Hunton lime enters the picture and causes so many question marks in the minds of oil men. Several companies in the Mid-Continent have made a careful survey of all the information available on every Hunton lime producing area in Oklahoma. All check fairly closely and indicate ultimate yields running from as low as 1,700 bbl. per acre to a top of 10,000 bbl. per acre, practically all on a 10-acre spacing. An average of the cream of Hunton production, say the best 30 per cent, does not exceed 7,000 bbl. per acre on 10-acre spacing.

In contrast to other Hunton pools,



Map 2: Bois d'Arc missing in old stream bed (hatched area)



Cross section showing position of the Bois d'Arc stratigraphic trap

West Edmond has differing conditions, some favorable, some unfavorable. It is considerably deeper than most Hunton production, the average depth being around 7,000 ft., and the wells are being drilled on a 40-acre pattern. On the other hand, there are no Hunton pools comparable to West Edmond in size. Most other Hunton production was pretty much a structural concentration of oil, whereas West Edmond is definitely a stratigraphic trap. Taking everything into consideration, numerous geologists and company officials have made their estimates of ultimate acre yield in West Edmond and the range is surprisingly narrow. They range from a minimum for the field as a whole of 4,000 bbl. per acre recovery to a maximum of 9,000 bbl. per acre. Most of the estimates fall within a range of 5,000 bbl. per acre minimum to 8,000 bbl. maximum. Furthermore all of these estimates are made with full knowledge of the previous history of Hunton production. In all probability, with the same set of data on the field to date, estimates of recoverable oil would be substantially higher if the producing formation was almost any strata other than Hunton.

Reserve Estimates Varied

Various estimates of maximum total producing acreage and maximum yields per acre seldom coincide, but the estimated range of ultimate recoverable oil will run from a minimum of 25,000 acres at 5,000 bbl. per acre to a maximum of about 30,000 acres at 7,000 bbl. per acre, or from 125,000,000 to 210,000,000 bbl. ultimate recovery. The average of a group of informed estimates is almost exactly 180,000,000 bbl. Any of these estimates definitely places West Edmond in the 100,000,000-bbl.-plus class and if realized, make it a major pool by any standard.

The question "Will it pay out?" is partially answered by the figures on acre yields and the intense drilling activity. However, this can be answered by a few simple calculations, using figures that are generally agreed upon as to costs. The following tabulation is based on a composite of estimated data exclusive of lease-bonus investment:

Per well yield, 40 acres at 6,000 bbl.		240,000
Gross rev., 240,000 bbl. at $1.25 per bbl.		$300,000
One-eighth royalty	$37,500	
Drilling cost and equipment investment per well	85,000	
Field oper. costs over life of field at 25c per bbl. (working interest)	52,500	
5% state gross prod. tax on working interest	13,125	
Total field exp. per well	$188,125	—188,125
Gross profit before overhead and admin. exp.		$111,875
Admin. and gen'l overhead at 20c per bbl. (working interest)		—42,000
Net profit, before inc. tax		$69,875

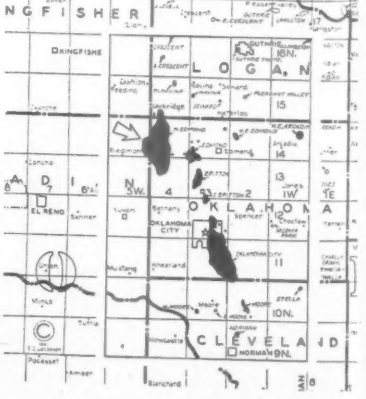
In general, most operators estimate that they will break even or make a slight profit on a 5,000-bbl. per acre yield, and that anything over that will net fair profits.

Basic geology of the field is relatively simple. The oil is found in the Bois d'Arc section of the Hunton lime at the tip end of a pinchout. (See diagram.) The pre-Pennsylvanian formations were deposited on the west flank of the Nemaha granite ridge to the east and dip westward into the Anadarko basin. Later they were exposed to erosion and the upper beds of the pre-Pennsylvanian section were beveled off as they turned sharply upward on to the flank of the Nemaha ridge, with results as illustrated in the diagram, forming a stratigraphic trap.

Wherever that unknown combination of conditions that results in nature's producing crude oil coincides with porosity in the Bois d'Arc (and perhaps other sections of the Hunton) near the tip of the pinchout, an oil field may be found. At West Edmond this combination existed, and so long as porosity and sufficient thickness of Bois d'Arc hold out in combination with these unknown conditions, geologists can only guess as to the north and south limits of the field. It is possible to make a reasonably fair guess about the approximate width, from the data on the pinchout to the east and the known water line on the west. However, such estimates are for the field generally, not for a particular tract, since the strike of the stratigraphic trap will almost certainly not follow an exact north-south line. Only a whole series of dry holes will definitely define the field.

Dry Stream Bed

Map 1 shows the general field development and contours on the base of the Bois d'Arc. The contours (solid lines where control data is sufficiently voluminous, dashed where insufficient control permits only estimates, subject to revision) show merely a fairly uniform north-south strike and an east to west regional dip. There are two noticeable peculiarities however. An old stream bed apparently ran east and west near the north line of the south tier of sections in Township 14n, Range 4w, and along its channel, the Bois d'Arc is sometimes completely eroded, with the result that there are several dry holes right in the heart of the field. In the same general area, as indicated on the map, there is a condition which indicates



Regional location of West Edmond pool

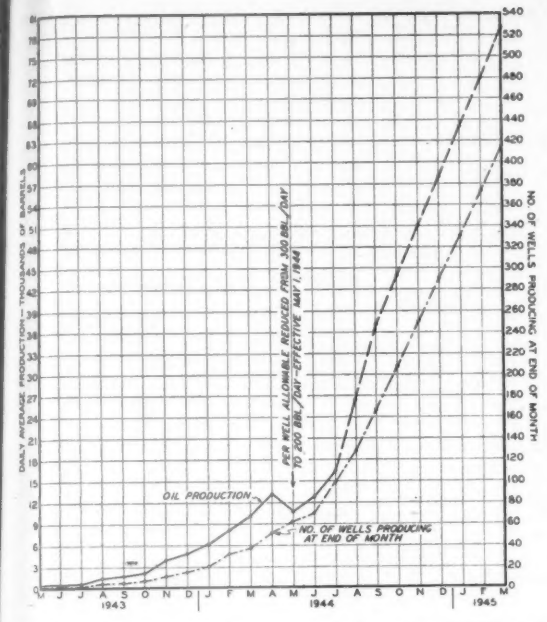

DAILY AVERAGE PRODUCTION—THOUSANDS OF BARRELS
NO. OF WELLS PRODUCING AT END OF MONTH
PER WELL ALLOWABLE REDUCED FROM 300 BBL./DAY TO 200 BBL./DAY—EFFECTIVE MAY 1, 1944
OIL PRODUCTION
NO. OF WELLS PRODUCING AT END OF MONTH
1943
1944
1945

Chart 1: Actual production and number of wells through August. Remainder of curves projected on basis of testimony before PAW pipe-line hearing

a fault, but on which most geologists are not willing to commit themselves definitely.

Map 2 is contoured on the thickness of the Bois d'Arc, and shows the course of the old stream bed in which the Bois d'Arc is completely eroded. On the basis of known data, the Bois d'Arc appears to be generally thicker in the south end of the field than in the north. This is subject to reservation, however, in that the control data toward the north is inconclusive and the contours may be altered considerably when more wells are completed. There is also some indication again subject to alteration by more complete data, that porosity is better in the south end than in the north.

Productive Limits Undetermined

The field may be reasonably expected to average 3 to 4 miles in width, in a generally east-west direction. How far north or south it may extend depends on indeterminable factors. To the south a recent dry hole in SW SE 19-13n-4w and an old dry hole in SE NW 27-13n-4w might determine the limits, or the oil-bearing portion of the Bois d'Arc might narrow down and pass right between them and continue on south. To the north a well is drilling in NE NE 18-15n-4w, 3 miles north and ½ mile west of the farthest north producer.

The growth of the field is shown in Chart 1, from the first pipe-line runs of oil from the discovery well in May 1943 through August 1944 with a projection to indicate estimated future probable increases in accordance with information furnished by some operators to the Petroleum Administration for War in connection with proposals for additional pipe-line gathering systems.

The quality of the crude and its attractiveness from a refining standpoint are indicated by the accompanying analysis, which agrees generally with a previously published Bureau of Mines analysis. (See The Oil and Gas Journal, March 16, 1944, page 61).

The oil is particularly high in lubricating fractions; wax distillate, wax slops and heavy bottoms totaling 44.8 per cent. Viscosity ranges from a decidedly light wax distillate, as fractionated in this anlysis, to 22.1° gravity bottoms, and pour points indicate a relative large percentage of paraffin wax. This is also borne out by field conditions, where some operators are already experiencing paraffin deposits in the tubing. The motor fuel fractions total 32.3 per cent, and the low 47 A.S.T.M. octane number on the 415° F. end point cut indicates it to be highly paraffinic. The heavy bottoms cut is reported "dark green" for color, which would indicate promising possibilities for bright stock yield. Barring refining difficulties not indicated in this analysis, the crude appears to be highly advantageous as a source of lubricating oils. The gas-oil fraction appears to be high in quality for diesel fuels as well as for cracking stock and household heating oil.

Previous discussions of West Edmond field, covering earlier development and engineering aspects were published in Journal issues of March 16, page 59; March 23, page 135; August 19, page 78; Highlights of development progress and production are published each week in the Exploration and Drilling Section. This report covers the payout probabilities, acre yield, ultimate size and general geology of the field which has the largest concentration of active rotary rigs in the country.

WEST EDMOND PRODUCTION RECORD

	Daily average production	Producing wells last of month
1943—		
May	378	1
June	403	1
July	569	1
August	1,353	4
September	1,630	5
October	2,019	7
November	3,926	11
December	4,755	15
1944—		
January	6,104	20
February	8,143	32
March	10,083	37
April	13,189	51
May*	10,713	62
June	12,677	69
July	16,285	99
August	21,300	123

***Allowable reduced from 300 bbl. per well per day to 200 bbl. May 1.**

CRUDE ANALYSES

Gravity, °A.P.I.	40.7
B.s. per cent	0.1
R.v.p., lb. per sq. in.	6.3
Color, 85/15, ⅛-in. cell	15
Ash, per cent	0.001
Acidity	None
16,000 cc. charged to 5-gal. still. Fire and steam distillation.	
415°-420° F. E.P. gasoline (over to	
Gravity	61.6
48.1 stream gravity), per cent	32.3
I.b.p., °F.	122
Maximum, °F.	415
Per cent off:	
150° F.	5
250° F.	49
284° F.	66
A.S.T.M. octane No.	47
Kerosene (48.1 to 40.3 stream gravity, per cent	11.6
Gravity	43.5
Flash, °F.	164
Fire, °F.	182
I.B.P., °F.	380
Per cent off:	
410° F.	19
10 per cent	401
Maximum	524
Gas oil (40.3 to 35.7 stream gravity), per cent	9.4
Gravity	38.0
Flash, °F.	240
Fire, °F.	265
Cold, °F.	4
I.b.p., °F.	490
Maximum	660
Per cent off:	
500° F.	10
550° F.	70
600° F.	75
Wax distillate (35.7 to 28.5 stream gravity), per cent	21.5
Gravity	32.4
Flash, °F.	315
Fire, °F.	355
Cold test, °F.	48
Viscosity (100° F.)	65
Paraffin slop (28.5 to bottoms), per cent	5.8
Gravity	27.8
Flash, °F.	430
Fire, °F.	490
Cold, °F.	82
Viscosity at 210° F.	49.8
Bottoms, per cent	17.5
Gravity	22.1
Flash, °F.	545
Fire, °F.	620
Maximum pour, °F.	90
Viscosity at 210° F.	205
Color	Dark green
Loss, per cent	1.9

OPA Certifies More Pools for Subsidy

WASHINGTON.—Several stripper-well pools were added by the Office of Price Administration last week to the list of pools eligible for premium prices and subsidy payments, retroactive to August 1, the date when the plan went into effect.

Other additions to the list probably will be added frequently during the next 30 to 60 days, but no more will be eligible for retroactive premium prices to August 1. Additions and changes in premium prices previously authorized are being made on the basis of information not available at the time the plan was instituted, and on information on average production per well during all of 1942 as supplied by producers in fields not included originally.

The following new fields were added during the past week:

Pool and county—	Premium, cents/bbl.
Indiana	
Alford, Pike	35
Barrett Mitchell, Gibson	35
Monroe City, Knox	35
Oakland City, Pike	35
Princeton East, Gibson	35
Dodd's Bridge (old shallow), Sullivan	35
Sullivan, Sullivan	35
Tri-County, Gibson and Pike	35
Santa Claus, Spencer	35
Kansas	
All pools, Bourbon	35
Climax, Greenwood	35
Faukhauser, Lyon and Greenwood	35
Lost Springs East, Marion	35
New Albany, Elk	35
Quincy, Greenwood	35
Winterschied, Coffey and Woodson	35
Louisiana	
Georgetown, Grant	20
Tulos-Urania, LaSalle and Winn	20
Oklahoma	
Boston Northeast, Osage	35
Cole, Payne	35
Penn Creek, Osage	25
California	
Chice Martinez, Kern	20
Wyoming	
West Salt Creek, Natrona	35
Arkansas	
Irma, Nevada	20

OPA has also made a change in the premium price for Caddo (Pine Island) pool in Caddo Parish, La., making it 35 cents per barrel instead of 25.

An order was expected this week establishing basic maximum prices for low-gravity oil in Oklahoma and Kansas, to which premium prices will be added when production is from stripper pools. The scale will be $1.25 per barrel for 40° gravity and up and ranging down to 83 cents for oil below 20° gravity. This is to meet a situation in which low-gravity oil has been bought at less than maximum ceiling prices, which would have resulted in producers getting less than the full premium under the subsidy plan.

Michigan Spacing Rules Relaxed Slightly More

WASHINGTON.—Oil wells drilled on 10-acre spacing in 12 counties in southwestern Michigan may now be drilled to a maximum depth of 1,650 ft. instead of the 1,400 ft. maximum that previously prevailed, the Petroleum Administration for War announced August 31.

The depth limit was increased by amending Supplementary Order 7 to Petroleum Administrative Order 11, which regulates the use of materials in petroleum production operations in the 12 Michigan counties. The amendment continues to require a 20-acre unit for wells drilled between 1,650 and 2,500 ft.

PAW officials explained that the relaxation of restrictions governing the use of materials required for drilling wells on 10-acre units will make possible the drilling of a limited number of additional wells in shallow pools that previously were governed by the 20-acre spacing restriction.

Affected by PAW action are producers in about 12 small fields in Allegan, Barry, Berrien, Branch, Calhoun, Gass, Kalamazoo, Kent, Muskegon, Ottawa, St. Joseph, and Van Buren counties in southwestern Michigan.

E. E. Robbins Is Appointed To World-Wide Oil Post

E. E. Robbins, former oil-equipment man of Tulsa, has been named by United States Steel Export Co., subsidiary of United States Steel Corp., as its world-wide oil representative. Robbins, who recently resigned as a liaison officer between War Production Board and Petroleum Administration for War will be accompanied late this month to Colombia, Trinidad and Venezuela by J. B. Graham, assistant general manager of sales for National Tube Co. of Pittsburgh, another United States Steel subsidiary.

Army to Buy Premium Fuel For Use in This Country

WASHINGTON. — Army vehicles in this country will shift from housebrand to premium gasoline in compliance with an order issued by the quartermaster general's office. This is because the quality of housebrand fuel has been lowered in order to conserve tetraethyl lead for overseas fighting forces. Army vehicles in the United States have been operating on regular-grade gasoline, since virtually all 80-octane material goes to European war theaters.

The action of the quartermaster general's office was taken upon recommendation of Army and industry technologists to guard against damage to engines which would occur from the use of a substandard fuel.

George Echols Disposes of Most of His Holdings

HOUSTON.—George Echols, independent operator in the South Louisiana, Gulf Coast and Rio Grande Valley areas, has disposed of most of his holdings for a consideration approximating $4,350,000. The transactions included not only properties held in Echols' name, but those of Titanic Oil Co. Echols retained interests in the Napoleonville, Westwego and Convent Dome fields in coastal Louisiana.

O. R. Mitchell and J. F. Gravis of San Antonio purchased the Echols holdings in Ascension Parish, Louisiana, for $3,500,000.

A Houston syndicate, composed of Louis and Harry Pulaski, Morris Rauch and Floyd L. Karsten, bought properties in the League City field, Galveston County; South China field in Jefferson, Hardin field in Liberty, and the University field in Louisiana. These properties include 18 oil producers with a daily allowable of 1,000 bbl.

The Jena, La., area, opened by Echols a year ago, was acquired by H. L. Hunt, independent of Dallas, and W. O. Woodard, Shreveport independent.

Near Donna, in the Lower Valley, a block of acreage was bought by Stanolind Oil & Gas Co. Acreage in Starr County went to W. H. Holland and associates. Several drilling rigs were included in the transaction.

DEATHS

Charles B. Creekmore, 79, independent oil producer and drilling contractor, died September 2 in Tulsa. He was president of Creekmore Drilling Co., and he worked on the first well drilled in West Virginia by The Carter Oil Co.

David Waxman, 46, manager of the asphalt sales department of Shell Oil Co., Inc., in New York City, died August 29 in Scarsdale, N. Y. He was a director and former chairman of the executive committee of Asphalt Institute.

William F. Eiting, 61, independent oil operator of Tulsa, died September 4. For many years he was associated with Baker & Lynch in that city.

Factors Controlling Oil-Well Completions in the Illinois Basin

*by Carl A. Bays**

THE most vital period during the development of an oil well is the time between the decision that it is of commercial value and its actual completion on production through the tubing. In the Illinois basin the Tri-State area of Illinois, Indiana and Kentucky (Fig. 1), production is characterized by low pressure, low fluid levels, and relatively small but long-lived wells. Production is mainly from the Chester (upper Mississippian) sands and the Ste. Genevieve (lower Mississippian) oolitic lime horizons, although Pennsylvanian, other lower Mississippian, Devonian, and "Trenton" zones are productive in various fields.

The present discussion is concerned mainly with the stages in well completion as particularly applied in the Illinois basin. No attempt is made to acknowledge any sources of the procedure, techniques, or other matter as they are generally common knowledge or common field practice. The writer was formerly engaged in consulting practice, specializing in those stages of drilling and completion that involve the handling of drilling mud, coring, electric surveying, control of measurements, setting pipe, cementing, drilling plug or perforating, swabbing in, shooting, acidizing, and generally making a well ready for the actual connecting and production. The work was designed to bridge the gap between the normal service of the oil-field geologist and the service of average farm boss or pumper who handles wells for independent operators. During the past 2 years, work with the Illinois Geological Survey has given an opportunity to review practices in general use by all operators. The writer's experience has been concentrated in the Wabash Valley area, and the generalizations reached here may not be broadly applicable to some fields in other parts of the basin.

*Geologist and engineer, Oil and Gas Division, Illinois Geological Survey. Published with permission of the chief, Illinois State Geological Survey, Urbana.

The author of this article received his B.A. and Ph.D. degrees from University of Wisconsin. He was then a geologist in the Philadelphia office of Sun Oil Co., from November 1937 to April 1939, when he resigned to enter the consulting field. He was consulting geologist and engineer in Illinois, Indiana and Kentucky, until March 1942, specializing in well completions. Then he became a geologist on the special groundwater staff at Illinois State Geological Survey until July 1943, when he assumed his present position. The second and concluding part of this article will appear in next week's issue.

Essential Geological Conditions

Pennsylvanian strata.—The Pennsylvanian zones (see Fig. 2, columnar section) include a number of more or less lenticular sands. The cores are generally tight, somewhat streaked, and permeability is generally low. Oil from Pennsylvanian zones in many areas is of low viscosity and relatively low gravity. Small wells are typical and recoveries are low. Many of the Pennsylvanian horizons are commercial only because of their shallow depth or because operators use maximum economy in drilling, equipping, and operating. A number of different sands are included in this generalization, and locally a number of different names are applied to the different zones. In most of the sands in the lower portion of the Pennsylvanian system a good water drive is present, and where fair permeability prevails better wells are obtained.

Kinkaid, Clore-Degonia, and Palestine.—The highest Chester sands that yield commercial production are the Kinkaid, Clore-Degonia, and Palestine sands. They are not consistent producing horizons and pay off only locally, for the principal production comes from scattered wells in White and Gallatin counties, Illinois, and Posey County, Indiana. In most of the wells the sands are rather thin, erratically

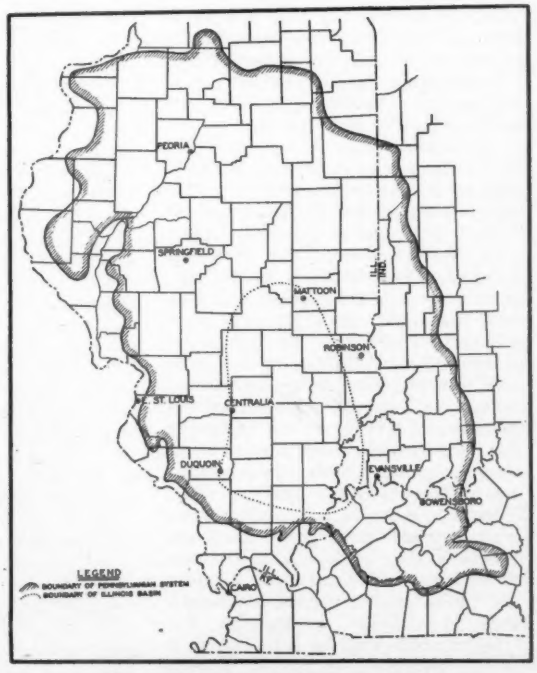


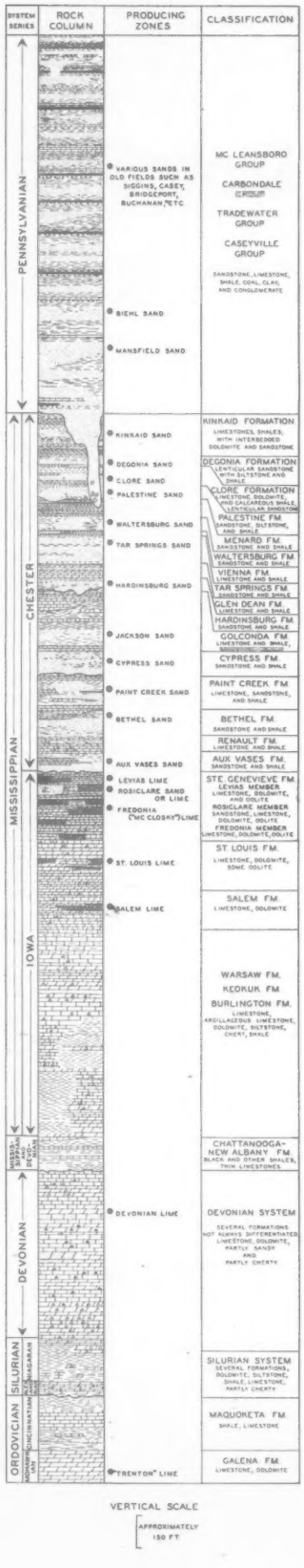
Fig. 1: Index map of the Illinois basin

tight, with low permeability. In many wells there is no recognizable oil-water contact, but instead an intermixture of connate water and oil in the producing zone and apparently a lateral water drive, so that the transition from oil production to oil-and-water production to water production is rather gradual. In general small almost noncommercial wells are typical of the Clore-Degonia and Palestine as developed in the Illinois basin to date. In some of the Gallatin County area a rather thick and well-developed permeable sand is present in the Palestine and a strong water drive with the oil "floating" has been noted.

Waltersburg sand.—The next lower producing zone is the Waltersburg sand. The sand is typically lenticular but the lentils are fairly well developed and where the structure is favorable, big wells and high recoveries are not uncommon. Wells drilled near the edges of Waltersburg lentils show little thinning of the sand section, indicative of the proximity to shaling out. The edges of the lentils are rather abrupt so that the producing zone may disappear from one 10-acre location to the next. The typical Waltersburg sand in the Wabash Valley is a fairly to highly permeable sand with few shale breaks and a gradational oil-water contact that occupies about 5 ft. or more. Reservoir gas expansion and water drives are both common. To all of these generalizations the Storms field in White County, Illinois, is exceptional in having a consistent, but more erratically permeable, sand body with a well-developed gas sand overlying the oil sand. In the Storms pool the oil is poor and production has been handicapped by the large volumes of gas.

Tar Springs sand.—The next producing zone beneath the Waltersburg is the Tar Springs sand which is separated from it by the thin Vienna formation. This zone changes greatly in character from the Wabash Valley fields to the Franklin County area and to the west. At the west side of the basin the sand is a consistent crossbedded, fairly permeable sand; it has a thick saturated zone and both good gas-expansion drive and water drive. In the central portion of the basin a thick watersand zone is typical with some interbedded calcareous sandy zones. In the eastern portion of the basin the Tar Springs generally consists of several sands with interbedded shales. The lower portion of the Tar Springs is normally a prolific water-producing zone and where the shaly interbeds are not developed the water generally drowns out oil production under normal open-hole conditions. To obtain commercial Tar Springs production in this area it is usually necessary to find saturation where there is a shale break above

DIAGRAMMATIC COLUMNAR SECTION OF THE ILLINOIS OIL BASIN



the oil-water contact. The lenticular character of such a shale break frequently means that wells at the same elevation and with essentially the same saturation conditions may not behave in the same manner on production, because one without a shale break will normally go to water readily. In the Wabash Valley such "floating" zones have been perforated in several wells in which there is production from a lower zone, and small production is received through these perforations that augments the regular production from the well, but the Tar Springs oil is produced at such a slow rate as to permit little water to come in. In these same areas similar wells in the Tar Springs alone have failed to make commercial producers.

Hardinsburg sand.—The Hardinsburg sandstone is irregularly developed and is not a significant producer in the Illinois basin. In the Iron pool, White County, where this sand is the principal productive zone, there are unusual reservoir conditions, first because the field apparently is a fault trap, and second because the locally thick Hardinsburg here cuts out the upper part of the underlying Golconda formation. In this field the Hardinsburg is fairly tight but is an excellent producer because of the constant rate of production and the thick sand body. Elsewhere locally in the Wabash Valley fields the Hardinsburg has been found to be saturated and has made commercial producers.

Golconda "Stray" sand. — Locally there is sand between the main Golconda limestone and the "Barlow" or lower Golconda limestone. This sand is known as the Jackson in Kentucky and is generally correlated as Cypress in Indiana. It is not a significant sand body in the Illinois basin fields, but in the eastern margin of the basin area at scattered places in Indiana and in western Kentucky it is locally an important producing horizon. This importance is primarily because of the shallow depth, for generally the sand is tight and irregular.

Cypress sandstone. — The Cypress sandstone is one of the most important producing sand formations in the Illinois basin. It usually has one to three sandstone zones. The upper one is locally a green sand and is commonly known as the "upper Weiler." In general, it is not important because it is tight and calcareous but in some fields it is a well-developed reservoir. The sand which has its top about 20 to 40 ft. under the Barlow limestone is the princi-

Fig. 2: Diagrammatic columnar section of the Illinois basin showing the producing zones. Lithologies and thicknesses are those typical of Wayne or White counties, Illinois, or Posey County, Indiana

pal producing sand. In some wells this sand is divided by shale so as to make three Cypress sands in all. The sands range from fine to medium grained, well sorted to poorly sorted quartz sand with low to high permeability and porosity. Lateral variations in texture and porosity are common and thin shaly lenses are numerous. Although many of the fields have a definite water table, the oil-water contact is usually gradational so that even though the well cores show apparently good saturation the sand will produce water in some localities when tested.

Paint Creek sands. — The Paint Creek formation, which consists of interbedded sandstone, limestone, and shale, contains sand-producing zones. There is considerable difference of opinion as to which strata can be classed as Paint Creek and which are part of the underlying Bethel. In the opinion of many geologists much of the production which is classed as Bethel should be called Paint Creek. In the Roland field, White County, Illinois, for example, the producing zone next below the Cypress is called Bethel, Paint Creek, and "Paint Creek-Benoist." In the New Harmony field certain sands below the Cypress are called both Bethel and Paint Creek. The higher sands that are certainly Paint Creek in the Wabash Valley area are locally productive, particularly in White County, Illinois. The sands are good reservoir sands and are typically consistent locally in texture and character. The lower sands which may be referred either to the Bethel or Paint Creek are productive over a much wider area. They are more shaly, they vary laterally in position, thickness, porosity, and permeability, and in quantity of shale present.

Bethel sand. — The Bethel sandstone is an important producing zone in the fields on the west side of the basin, particularly Salem, Woodlawn, Centralia, and Louden. In these fields the sand is well developed and although it has local shaly lenses, it is commonly a good homogeneous reservoir with good permeability and porosity. The Bethel is one of the most productive zones in the basin because of the richness of saturation and because the sands are thick and continuous. Eastward in the center of the basin and on the east side the zones classed as Bethel are as described for the Paint Creek, although locally in the Wabash Valley, thick homogeneous and consistent sand bodies are present. The Bethel generally has a well-developed water table but the oil-water contact is commonly gradational through a few feet. On several of the Wabash Valley structures the entire sand is above the oil-water contact in most of the field so that the water drive is lateral in effect.

Aux Vases sand. — The Aux Vases sandstone is an important producing zone in the Illinois basin and is rather unusual in its characteristics. Normally it is a fine-grained and highly calcareous sand. Local tight spots are developed by its becoming more calcareous or by shaling out. Because of its fineness and general irregularity, under normal conditions the sand reacts to shooting with good increases in production. Electrical logs usually show low resistivity. and the sand was called a water sand for a considerable period. Generally on the west side of the basin the Aux Vases sands are coarser and less calcareous. In rotary-drilled wells the key to whether the Aux Vases is productive is in core analysis and drill-stem testing. Because of the fineness of the sand it may be difficult to recognize a show in cuttings. As a general rule, in order to avoid missing commercial Aux Vases wells, a drilling-time break sufficient to suggest the presence of porosity should justify the cutting of a core, and a show of oil in an Aux Vases core should justify the running of a drill-stem test and careful core analysis.

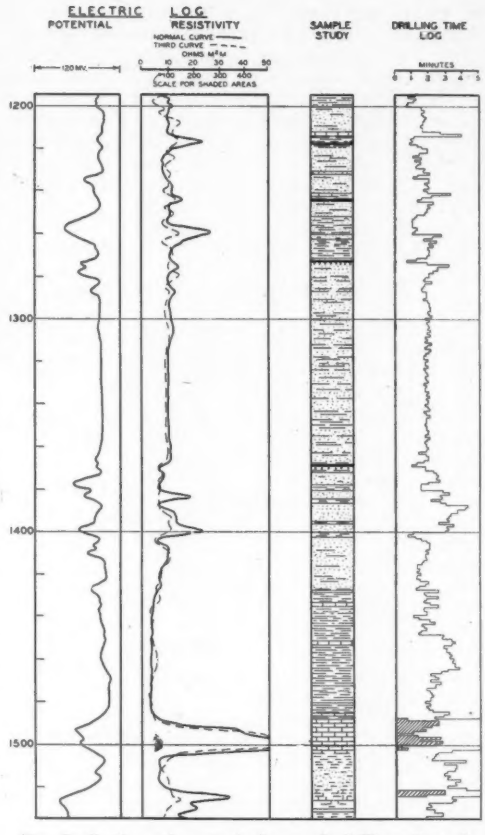


Fig. 3: Portion of a typical sample-drilling time-electric log

Ste. Genevieve zones. — The Ste. Genevieve formation is commonly divided into three members, the Levias, Rosiclare, and Fredonia. In common usage the term McClosky applies to the porous oolitic strata of the Fredonia, although commonly any oolitic zone in the Ste. Genevieve has been called McClosky. An oolitic break occurs locally in the Levias limestone, and in a number of fields this zone is productive in a few wells. Occasionally oolitic limestones have developed in part of the Aux Vases formation, even above the main Aux Vases sandstone, and in some areas these zones are correlated as Levias and in others they are recognized as Aux Vases. In general they are not significant producing zones. The Rosiclare ranges in character from an oolitic limestone to a sandy oolite to a calcareous or siliceous sandstone, and is productive at one or more localities in all of these facies.

The oolitic zones of the Fredonia are the most important oil-producing zones in the Ste. Genevieve. These oolitic sections vary laterally in thickness, permeability, and degree of dolomitization from one location to another. Structure plays an important part in control of McClosky production where the oolitic strata are continuous, but there are a number of places where production occurs without regard to structure but is controlled by updip destructive dolomitization or pinchout of an oolitic zone. Apparently in any one area the oolitic zones may be continuous or discontinuous so that a zone present at one location on a structure may not be present at another. The McClosky zones are characteristically flashy producers, having high initial production, giving great increases from acidizing, and declining sharply. However, McClosky wells which do settle at a commercial rate of production after the flush is gone apparently are long lived and fairly consistent producers. Both gas-expansion and water-drive production are common in McClosky fields, although it seems probable that gas-expansion drive is more important, at least in the early stages.

Zones below Ste. Genevieve.—Except locally for the Carper (basal Osage) and the Hoing (Devonian) sands in the margins of the basin,

the producing zones below the Ste. Genevieve in the Tri-State area are oolitic limestones or crystalline limestones or dolomites. These includes zones in the St. Louis and Salem formations in the Mississippian and the Devonian and Trenton* which are productive on the west edge of the basin. The writer has not had enough first-hand experience with these zones to present a detailed picture of them.

Drilling Practices

In the Illinois basin careful and intelligent practice during drilling may obviate a number of the difficulties of completion. Care of the drilling mud used in the drilling, testing and completion of a well, attention to accurate measurements, careful sampling, coring, and keeping of logs and drilling-time records are very important to the ultimate productivity of a well. In spite of extreme care in all of these matters there are a number of wells in the Illinois basin in which pipe either should not have been set or an oil well should have been completed.

Drilling mud.—Common practice in the handling of drilling mud is to drill the Pennsylvanian strata or drill to the top of any expected pay before mixing mud. Some contractors drill until they are ready to run an electric log before mixing mud. An analysis of costs to contractors, considering total costs, including time lost on fishing jobs, reaming bridges, lost circulation, and trying to get an electric survey electrode to bottom, indicates that the least expensive method of operation is to drill the plug on the surface pipe with the drilling mud in condition and to maintain it that way by frequent jetting of pits and mixing of new mud all during the drilling of the well. Commercial gel muds and fresh water make the most suitable drilling mud for Illinois basin wells although in many circumstances other constituents may be used to maintain a low-water-loss mud. Sufficient calcareous material comes from the limestones to make the addition of lime unnecessary and frequently disastrous to the quality of the drilling mud. It is good practice to test salinity, water loss, and pH of the mud during drilling of all wells, and where mud difficulties have been encountered, to have a resistivity test run on the mud several days before running the electric log of the well so that conditions can be made suitable for the proper recording of the electric log. In general with the use of commercial gel muds, frequent jetting and gunning of pits to maintain clean and thoroughly equalized mud of 9.6 to 10 lb. per gal. in weight and 38 to 44 seconds viscosity A.P.I. will eliminate difficulty. Such muds will usually have low water loss and will give most satisfactory drilling conditions. Care should be taken in running drill-stem tests to see that no salty water or oil gets into the pits to flocculate the mud.

If the mud has become salty from some of the Pennsylvanian or deeper sands it is possible to avoid mixing new mud by the use of gels designed to stay in suspension in salt water, provided the salinity and resistivity are still within the range of suitable electric logging.

Another aid to mud is a box cellar if a flow nipple is not used. A cellar should be dug in any event so that bradenhead can be put below the ground, the casing head set low, and high pump bases made unnecessary. If a cellar without flow nipple is used, a trough to pits should be constructed to protect the mud, and the cellar should also be equipped with a jet so that frequent jetting is possible.

Measurements. — Accurate measurements are as necessary to completion as to drilling. Common practice is to take measurements from the top of the kelly bushing or the top of the rotary table. During drilling it is common practice to keep a pipe tally and run a steel line at frequent intervals, particularly at coring points. It has been found that steel-line measurements to the top of the float section in the drill pipe and the keeping of pipe tallies are both subject to error. A good check method is to strap the pipe in the derrick occasionally, particularly at coring points, as a verification of drill-pipe and steel-line measurements. It has been found that the use of a foot and tenths tape instead of the standard foot and inches tape eliminates considerable chance for error both in taking measurements for the pipe tally and for strapping drill pipe. An ideal set of measurements is one in which the pipe tally, steel-line drill pipe measurements, open-hole line measurements (if taken), casing tally, and steel-line casing measurements for any well all check to a foot. Unless such measurements are obtained there is some possibility of doubt which may ultimately affect the completion of a well. If there is any discrepancy in measurements a good practice is to check the tops of markers as picked from sample-study and 1-ft. drilling-time records against the electric-log record so as to locate the error exactly. It is helpful to record measurements in terms of footage of "zero," the rotary table or kelly bushing above the ground, but even better methods include an accurate measurement of the footage from the top of surface pipe or top of bradenhead, if pipe is set. It is easy to sight the bushing or table with a simple hand-level, and then by sighting at the same level to a nearby tree or other more or less permanent marker and by setting a nail, notch or stake for zero, there is a ready reference after the rig is torn down and during tailing in. In the writer's opinion no one or two of the various methods of measurement should be trusted by itself, and where possible or where variations exist all should be used.

Sampling and logging.—In order to obtain a clear picture of the strata in a well, careful sampling is essential. The samples are caught in a properly constructed, easily cleaned sample box at either regular footage or regular time intervals during drilling. A record should be kept so as to indicate at what point in relation to the samples trips were made, and at what points there may have been circulation in the hole without drilling being in progress. To interpret the samples a drilling-time record is essential. The drilling-time record also affords an accurate check on measurements. A log based on samples and drilling time should be available for each well, and in the writer's opinion it is essential to the proper interpretation of many features in the electric log (Fig. 3). Careful logging will provide a knowledge of casing seats, caving characteristic of formations, cementing difficulties that may be

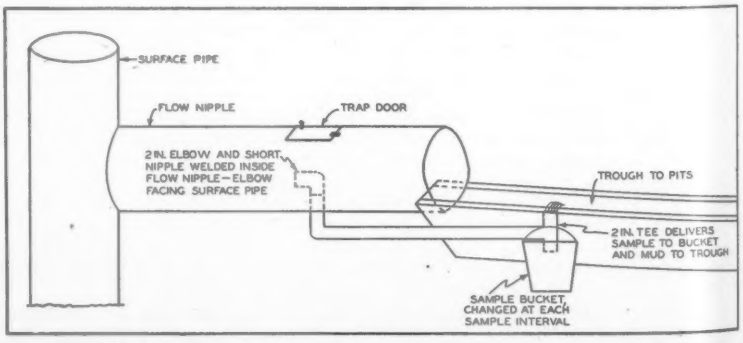

SURFACE PIPE
FLOW NIPPLE
TRAP DOOR
2 IN. ELBOW AND SHORT NIPPLE WELDED INSIDE FLOW NIPPLE—ELBOW FACING SURFACE PIPE
TROUGH TO PITS
2 IN. TEE DELIVERS SAMPLE TO BUCKET AND MUD TO TROUGH
SAMPLE BUCKET, CHANGED AT EACH SAMPLE INTERVAL

Fig. 4: Device for catching samples of rotary cuttings used by Pure Oil Co.

*Description of Trenton production to 1941 is given in Cohee, George V., "Trenton Production in Illinois," Ill. Geol. Sur., Illinois Petroleum, No. 39, 1941.

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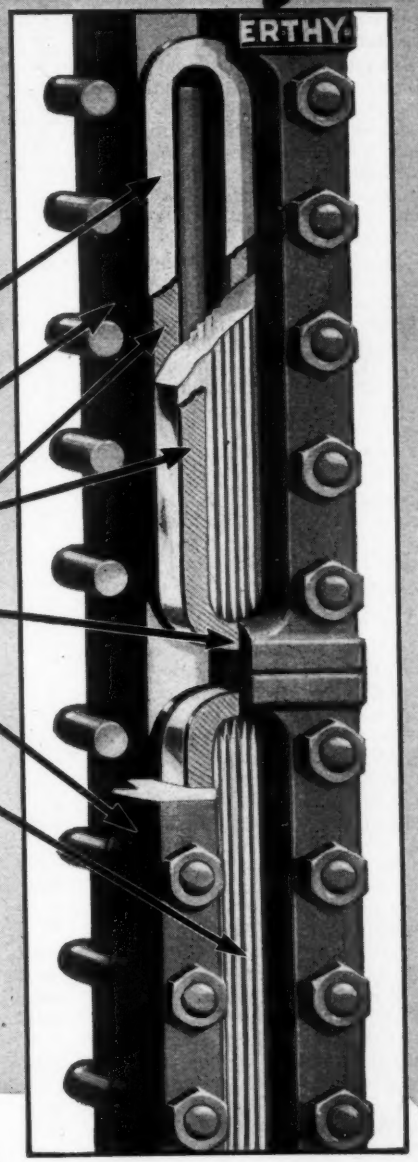

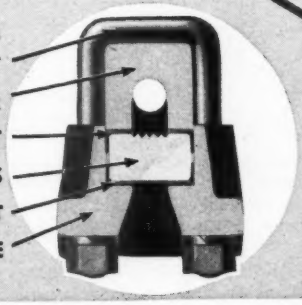

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encountered, and a number of other important facts not directly related to the pay zone but important in completing the well. Electric logging is common practice in almost all the rotary wells drilled and its merits are obvious, although most successful interpretations are based on close correlations with sample drilling-time logs.

Sample boxes in current use in Illinois are either obstructions in the return ditch or trough or are designed to sidetrack cuttings into a box from the main trough or ditch. A sample catcher that was devised by employes of Pure Oil Co. is being more widely used and offers many advantages (Fig. 4). A 2-in. elbow and nipple facing the surface pipe are welded into the flow nipple. A connecting pipe to a tee delivers cuttings to a bucket and excess mud to the ditch. Buckets are changed at the end of each sampling interval. Experimentation with position of the elbow in the flow nipple will give the most desirable sample size and eliminate much sample contamination.

Coring.—Coring is the most important means for obtaining information needed in the completion of a well. It is general practice to penetrate sands and circulate up samples to see whether the sand is saturated. This gives little information as to the top of the sands and the character of casing seats above them. On the other hand, economical operation does not normally permit the cutting of cores above the top of the various zones because of the erratic character of most of the sands in the Illinois basin.

During several hundred coring jobs, observations were made involving weight run, speed of rotary, pump pressure, and coring time. The writer has concluded that the average driller can obtain good recoveries under any number of variable conditions. The most important factors seem to be circulating cuttings and cavings from the well for a period that varies with the depth and return time prior to coring, and having the drilling mud in proper condition. Where cores are not recovered in spite of these precautions it is economical in many instances to run side-wall coring or sampling devices to obtain full information concerning a possible pay horizon.

Core analysis. — The cutting of cores loses much of its value of the cores are not examined by someone experienced in that type of work and if determinative core analyses are not run. The core analysis by itself cannot be considered as an index to productivity but it furnishes valuable aid when used with the electric log and other methods of study. The most frequent reason for undependable core analysis lies in the improper selection of samples

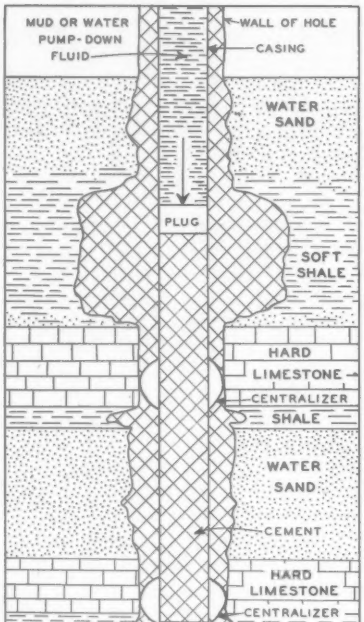

Fig. 5: Diagram showing typical conditions for cementing an oil string. The shoe is set exactly at the top of the sand and centralizers are set in the hard limestones

and in careless handling of the samples before they reach the laboratory. The samples should be typical of the core and pay zone. Proper directions for selection of core samples and the wrapping and handling can usually be obtained from the engineers who run core analysis for the service companies. Because of demonstrated evaporation loss from cores, in the writer's opinion the porosity and permeability determinations are most indicative of the type of reservoir. All saturation data are also important but they are more difficult to evaluate.

Setting Pipe

After a decision has been made to attempt to complete a well as a producer, the setting of pipe is the next important stage. The decision to set pipe on wells without having collected sufficient data to indicate a commercial well has accounted for numerous failures in the Illinois basin, many of which are blamed on bad cement jobs and other poor completion techniques. However, there are a number of wells which are known by their later records to have been bad cement jobs. Most of these could be avoided by taking due precautions in the setting of pipe. Where they do occur it is the writer's opinion that they should not be blamed entirely on the cementing company that merely mixes the cement and pumps it down the pipe but rather on the procedure followed in the drilling, preparation of the hole, and actual running of the pipe.

Casing seat. — The picking of a suitable "casing seat" is essential to a successful cementing job. Of course, in most rotary holes in the Illinois basin, the pipe is swung and not set on a seat, but the spotting of the shoe in terms of formation is of importance, and this point in the well is usually referred to as the casing seat. Most of the producing sands are overlain by shale and this in turn by a limestone. The shale interval varies from very thin to 30 or 40 ft. in some zones and in some wells. In some zones, but varying from one locality to another, the shales range from hard, firm, splintery, possibly calcareous shales to soft, rather rotten shales. Some shales are suitable for setting casing and others are not. The soft shales, in general, pump out so that the hole diameter is excessively large. With the construction of the overlying limestone where the hole is probably near diameter, the cleaning of the bottom of the hole and proper even cementing is difficult. Some of the apparently hard shales are exceedingly brittle and pump out much the same as the softer shales. The limestones in general make excellent casing seats, but since in many wells they overlie shales which cave, they cannot often conveniently serve. If the oil sand is to be produced from pipe set above it, it is frequently necessary to spot the shoe right at the top of the sand, neither high enough to expose any shale nor low enough to cut off any essential portion of the producing zone. The importance of exact measurements in such cases is obvious. Experience has shown that where the selection of a casing seat is somewhat hazardous, series cementing is sometimes a help. Also where no evidence from samples or cores can be brought to bear on the character of a casing seat, a caliper survey is useful. It is also a guide in cementing, logging, and other matters related to the well.

Conditioning the hole.—Prior to

the setting of pipe it is usually necessary to condition the hole. Experience has shown that reaming down after coring and before setting pipe or running drill-stem test will generally allow a better cement job. In running a drill-stem test it is better to test a section which has been cored in larger hole with a wall packer than with a cone-type packer set on top of the rat-hole. A certain amount of caving sometimes takes place in holes that are properly mudded if many trips, much coring, drill-stem testing, etc., has taken place in the final drilling stages. Most wells have a waiting period between the completion of the electric logging and the actual commencement of pipe running. At the end of this period the well should be conditioned for pipe running. Equalized mud of proper weight and viscosity should be circulated until the hole is free from caving and cuttings. Zones where reaming has been done should be checked with the bit going into the hole to make certain that they are to diameter. During the waiting period the well should be kept full of mud. It is undesirable to thicken mud at this time if the mud has been carried at near the proper weight and viscosity because an increase in weight and viscosity, particularly the latter, frequently causes undesirable caving whereas equalized mud near the proper composition will usually serve to condition satisfactorily. A check of returns will usually indicate whether the hole is cleaned up.

The oil string.—The oil string in Illinois is normally equipped with a guide shoe, float collar at top of first joint, a combination float and guide shoe, or some wash-down or whirler variation of guide and float equipment. Various devices are used for centralizing the pipe in the hole. In the writer's opinion centralizing equipment is essential to successful cementing in the Illinois basin. It has been found that a careful study of the well log so as to spot centralizing equipment on the pipe string so that it is placed opposite hard limestones rather than shales or sands makes centralizers more effective. It has also been noted that in some cases the use of centralizing equipment at one place on the string may force the pipe against the wall above if the hole is slightly crooked. This is shown by temperature surveys indicating a lack of cement above the centralizing equipment; whereas if two or three centralizers, properly spotted, are used a more even distribution of cement normally results (Fig. 5). It is customary to spot-weld the lower several joints of pipe together so as to strengthen the string against the stresses of tailing in.

Amount of cement.—The amount of cement used is normally computed by assuming the theoretical fill per sack for the diameter of the hole and using a safety factor of several times the amount necessary to properly shut off fluids back of the pipe, cover high pays above the bottom of the pipe, serve as support for the pipe against the stresses and jars of tailing in and properly cushion the string in event the well is to be shot. The only safe method to determine the amount of cement is on the basis of a caliper survey (Fig. 6) or else to use greatly excessive amounts of cement to be on the safe side as experience has shown that shale zones make large cavities, as sometimes do the soft sandstones that some horizons occasionally will take cement, and that frequently mud occlusions which may occur cannot be displaced with a small amount of cement slurry.

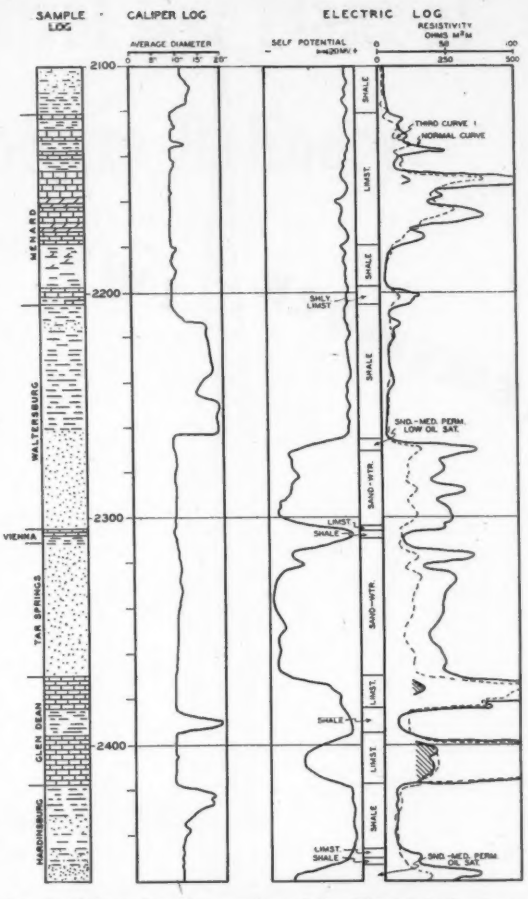

Fig. 6: Caliper log of a portion of the Chester series in an Illinois basin well with sample log and electric log to permit comparison. Note caving of soft shales

Casing measurements.—Casing run into a well should be carefully tallied. The casing should be set on bottom and picked back up to the casing seat sometime during or prior to the conditioning of the hole after pipe is run. Steel-line measurements should be run inside the casing string and checked against the pipe tally, casing tally, electric log, and other measurements.

Conditioning after casing is run.—After the casing is run into the hole, the hole should be further conditioned for cementing. Circulation through the casing with frequent movement of the casing and rotation where possible greatly aid in cleaning up. Returns should be carefully noted as to whether they indicate a clean hole. It has been found that where there are caving shales or mud occlusions, circulation of 5 to 10-minute "slugs" of clear water back of the pipe will tend to remove these undesirable conditions.

Cementing.—When the hole is conditioned after pipe is run in, the well is ready to cement. Several operators with very few cementing failures attribute their success to rotation or moving of the pipe during cementing. Careful measurements on top of plug are usually made. It is nearly always desirable to leave some cement in the pipe. In many wells the plug may coast a few feet after pump pressure is cut off so allowance should be made for this. Also in cases of faulty float equipment the leaving of some cement has saved recementing in several wells.

Observations during "waiting-on-cement" period.—During the waiting period while the cement is setting, it is usually desirable to run a temperature survey to check the cement job, particularly when it was desired to cement through pays some distant above the bottom of the pipe. Another check on the cement job is to run a steel line on top of the plug before drilling in so as to determine whether there has been any leakage or coasting of the plug. Such measurements are often a help in reconstructing the conditions in wells that are thought to need workover jobs.

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CHEMICAL ENGINEERS AND CONSTRUCTORS

Operation of the Central Gas Plant at The General Petroleum Refinery

by Randal Maass*

THERE have been times when sufficient normal butane was available so that the sale of liquefied petroleum gas has been limited by the available propane. Under such conditions, the value of propane is enhanced to such an extent that additional effort can be made to increase its extraction. At the present time large portions of the normal butane supplies are being used for the manufacture of butadiene, for isomerization to isobutane, and for furnishing volatility to the heavy gasoline stock now used for motor fuel. With the normal butane thus diverted, sufficient propane is readily available for blending with the limited amount of normal butane allotted to L.P.G. sales and no unusual efforts need be made to increase its extraction. It may be possible to increase this propane demand somewhat by developing the market for pure propane fuel.

In the treatment of refinery gases, the presence of valuable unsaturates makes high extractions economically attractive because of the recovery of these components. That is, if a high propene extraction is sought, a high propane extraction is a natural result. At our Torrance refinery we have installed, in connection with our 100-octane plant, a 11,000-M.c.f. per day gas plant designed to handle vapors from the entire refinery. For the first several months of its operation only a portion of its 600-gal. per day oil-circulation capacity was needed to meet design extractions. The excess capacity was therefore used to increase extractions above design.

Results at Gas Plant

The results we have obtained at our central gas plant are plotted in Fig. 1. In this curve the percentage extractions for the various components are plotted against the absorption factors. The solid curve is the operating line representing the over-all plant extraction; whereas, the dotted curve represents the extractions obtainable for a single four - theoretical - plate absorption. The points that represent the propane extraction range from well above 80 per cent down to almost 60 per cent. The gradually decreasing extraction is a result of an increasing load at the absorption plant.

The gas plant was first started in October 1943. Being the first of the new 100-octane units to be started, it operated only on the vapors from the old refinery; that is, from the visbreaker, reformer and straightrun units which amount to about 4,000 M.c.f. per day. The alkylation unit was placed in operation in January 1944. However, this unit contributes less than 500 M.c.f. per day. Two T.C.C. units were placed in operation in March 1944, which added 3,500 M.c.f. per day. The last of the four T.C.C. units has just been placed in operation and the total T.T.C. gas now amounts to 7,000 M.c.f. per day, bringing the total to the gas plant to about 11,000 M.c.f. per day. At times this volume may increase to 13,000 M.c.f. per day. Since 3 or 4 million of this volume is low-pressure gas and goes directly to the low-pressure absorber, a large proportion, that is about 70 per cent, of the oil circulation is used at the low-pressure absorber. To reduce this demand we are making use of some compressor capacity that is available a large part of the time to compress this low-pressure gas for high-pressure absorption. Thereby we hope to again approach 80 per cent propane extraction. Eventually compressor capacity will be available for the full-time compression of this low-pressure gas.

Fig. 1 also shows the average extractions obtained from October 1943, through April 1944. It will be noted that average propane extraction was 76.5 per cent and the isobutane extraction 97.8 per cent. Fig. 1 has also been used to determine what extractions will be on the average when 80 per cent propane extraction is again attained. These extractions are tabulated in Table 1. For a propane extraction of 80 per cent we will obtain an isobutane extraction of 98.4 per cent which is materially above the design estimate of 94 per cent. Constituents heavier than isobutane for all practical purposes are completely absorbed. Along with the propane, we will extract about 73 per cent of the propene in the gas with relatively small amounts of ethane and hydrogen sulfide. To obtain these extractions it is necessary with

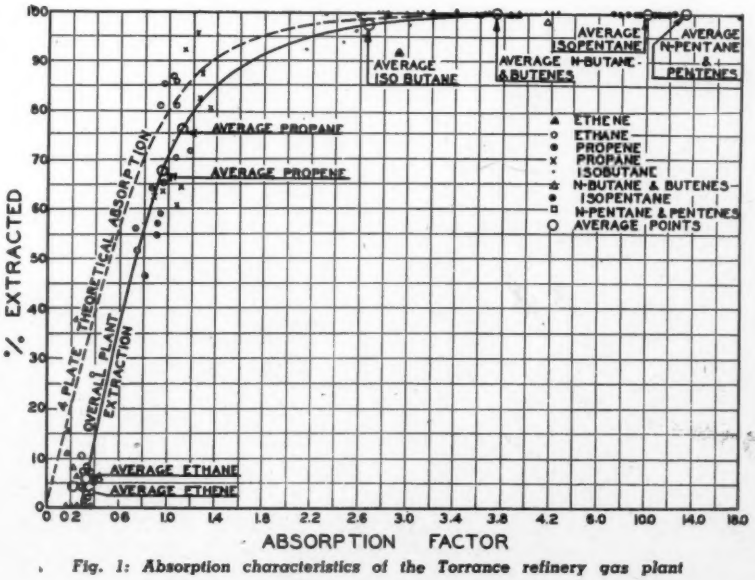
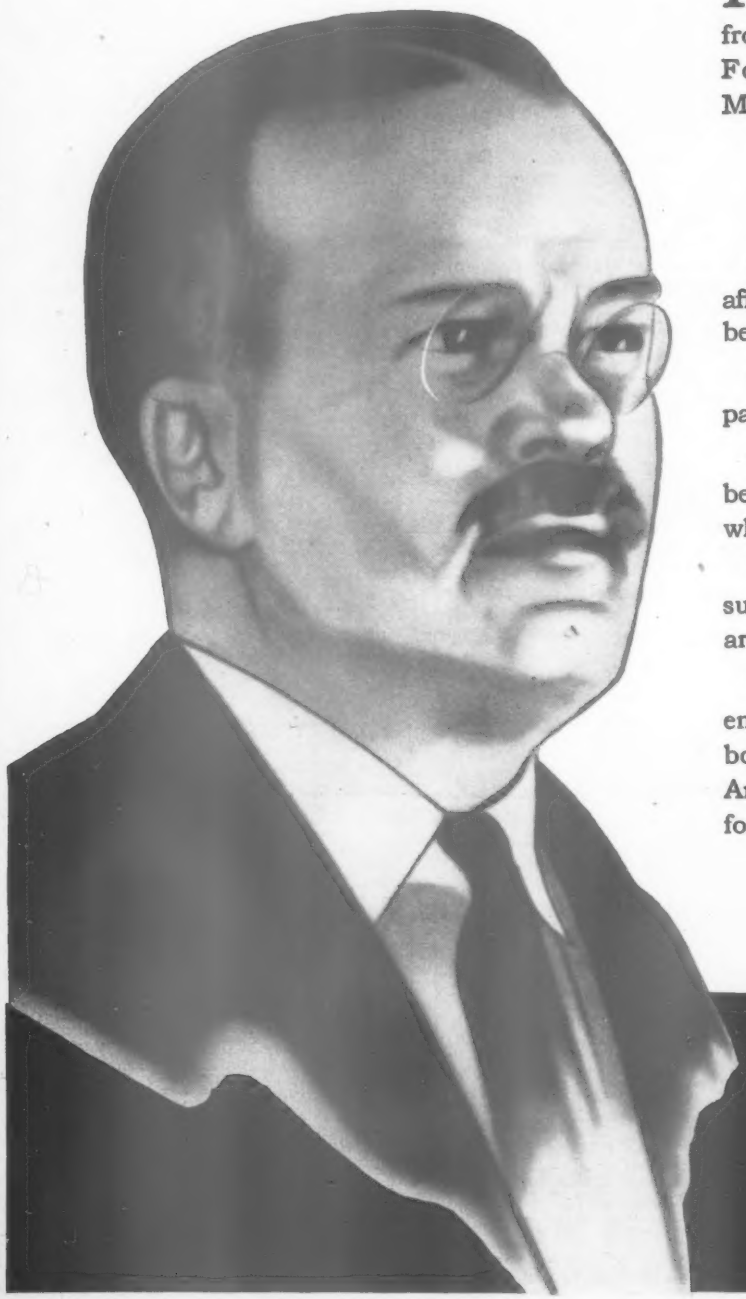


Fig. 1: Absorption characteristics of the Torrance refinery gas plant

*Refinery engineer, General Petroleum Corp. of California. Presented at August 1944 meeting of California Natural Gasoline Association at Los Angeles.

Then he said to himself

"BEGINNINGS HAVE BEEN MADE!"



IN April when the Red Army had backed the Nazis beyond Soviet frontiers for the first time—Russia's Foreign Commissar Viacheslav Molotov announced:

> "In the full re-establishment of the Soviet frontier . . . beginnings have been made."

We now see the magnitude of affairs stemming from these simple beginnings.

Well he knew that the principal part of any project is the beginning.

Well he knew that an improved beginning symbolizes an improved whole.

Well he knew that from such successful beginnings comes the ardor of pursuit.

This ardor of pursuit, well exemplified in Russian fields, symbolizes the beginnings of many American factories now preparing for the postwar invasion of markets.

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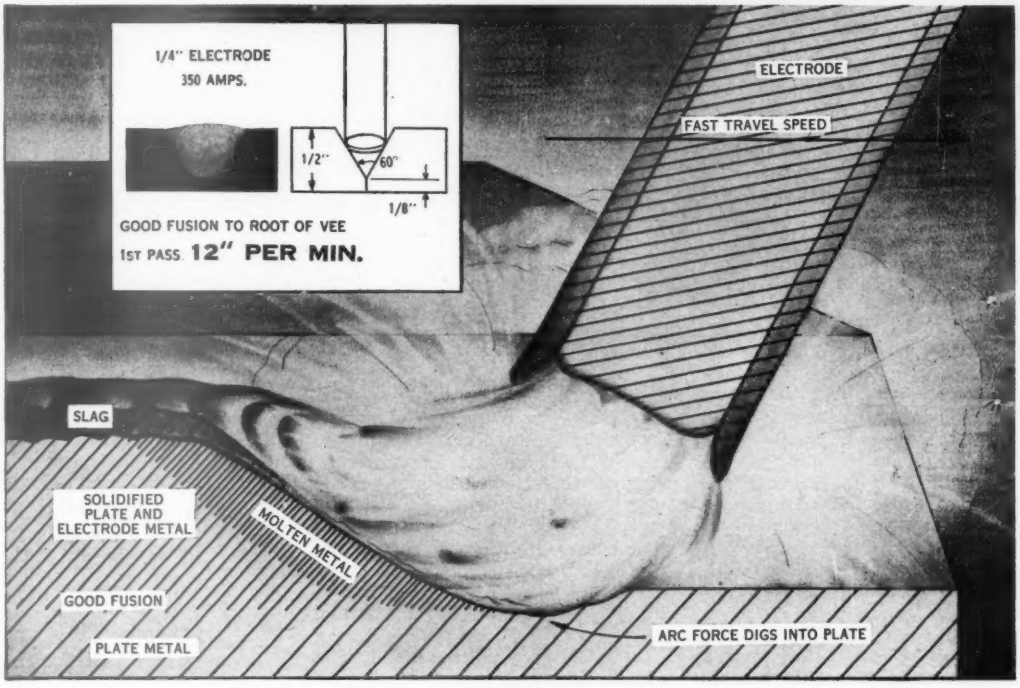

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ARC WELDING

our process to use a propane absorption factor of 1.21 which corresponds to a normal butane absorption factor of 4.07. These factors are considerably higher than normally employed in gas absorption plants.

The type of gas we handle contains about 20 per cent hydrogen, 3 per cent nitrogen and 30 per cent methane. The total ethane and lighter content of our wet gas runs about 68 per cent which is not too far removed from the type of wet gas treated in natural-gas plants. The extract, however, is made up of principally C_3 and C_4 compounds. The C_5 content is about 7½ per cent with no appreciable hexanes and heavier. The dry gas, because of its high hydrogen content, has a heating value in the neighborhood of the familiar 1,100 B.t.u./ft.³

TABLE 1—WET GAS AND PRODUCTS, REFINERY GAS PLANT
(80 per cent propane extraction)

Constituent—	Wet gas, mol. %	Absorption factor	Per cent extracted	Extract liq., %	Dry gas, mol. %
Hydrogen	19.6	....	0	....	27.6
Nitrogen	3.1	....	0	....	4.3
Methane	29.7	0.044	0	....	41.6
Ethene	3.1	0.24	0	....	4.3
Hydrogen sulfide	2.2	0.355	7.5	0.3	2.9
Ethane	10.0	0.37	9.3	2.7	12.7
Propene	6.7	1.03	72.7	15.0	2.6
Propane	13.9	1.21	80.0	36.7	3.9
Isobutane	4.1	2.93	98.4	15.3	0.09
Butenes	3.2	4.07	99.7	11.5	0.01
n-Butane	2.7	4.07	99.7	10.4	0.01
Isopentane	0.4	11.0	100.0	1.9	....
Pentenes	0.6	14.4	100.0	2.6	....
n-Pentane	0.7	14.4	100.0	3.1	....
Total	100.0			100.0	100.0
Volume	11,000 M.c.f./day			90,760 gal./day	7,830 M.c.f./day

Process

The process used in obtaining the above extractions is diagrammatically illustrated in Fig. 2. The plant is a standard two-stage absorption plant in which the rich oil from the 120-lb. high-pressure absorber is flashed in the bottom of the 35-lb. low-pressure absorber. The combined rich-oil stream is vented at 15 lb. and the vent gas recycled via a compressor back to the high-pressure absorber. The raw B-B extract and the lean oil are separated in a 30-plate rich-oil fractionator using raw B-B as a reflux and a forced circulation, direct-fired heater operated at 520° F. as a reboiler. The reflux accumulator is operated at 115 lb. so as to retain all the C_3 and C_4 fractions. The uncondensed vapors from the reflux accumulator are cycled to the low-pressure absorber.

The dry gas from this plant is used as refinery fuel. The raw B-B extract, together with the raw B-B from the other refinery units, is used as a charge stock to the HF alkylation unit, after the C_3's and normal pentane and heavier have been removed.

Equipment Design

Table 5 lists the essential design features of the several towers in this plant. The high-pressure absorber is a 6-ft. vessel with 26 single crossflow bubble trays. In addition, the tower is provided with two boots to accommodate the removal and return of the intercooling streams placed one-third and two-thirds of the way down the tower. These boots are a solid tray provided with a vapor chimney in the center. The intercooler pump takes suction at the inlet weir and discharges at the outlet weir. Diametrically across the center of the plate and parallel to the inlet and outlet weirs, a third weir is placed which is somewhat lower than the outlet weir. Since the intercooler pump may circulate more or less than the downflow, this third weir provides a means of transferring fluid from the discharge section to the suction section, or vice versa, and yet tends to keep the hot and cold oil separated.

The low-pressure absorber is a 5-ft. vessel also equipped with 26 single crossflow bubble trays and provided with the two boots. This tower, however, is operated at present with intercooling at the lower position only. The results plotted in Fig. 1 are therein compared to a four-plate theoretical absorption curve. Four theoretical plates out of 26 represent an efficiency of 15 per cent. This efficiency corresponds with that predicted from the corre-

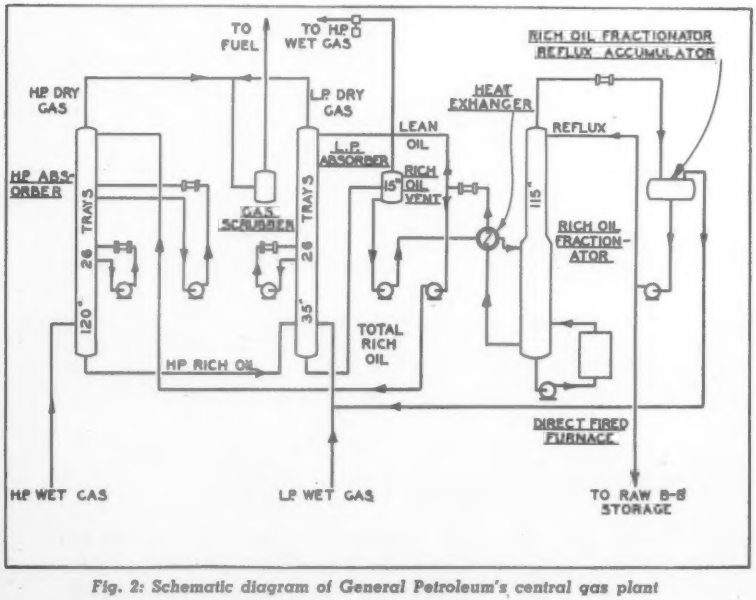


Fig. 2: Schematic diagram of General Petroleum's central gas plant

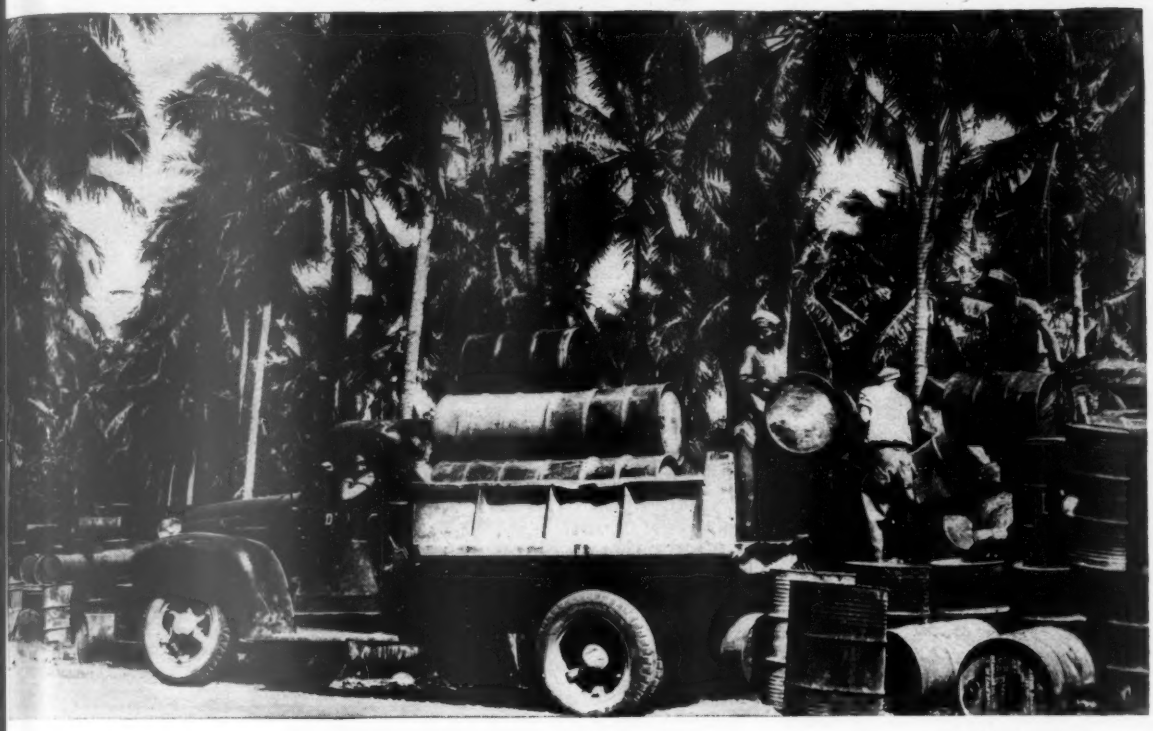
TABLE 2—ABSORBER OPERATING CONDITIONS, REFINERY GAS PLANT
(80 per cent propane extraction)

	High-pressure absorber	Low-pressure absorber
Pressure, lb.	120	35
Temperatures:		
Lean oil, °F.	75	75
Top intercooler, in/out, °F.	85/80	..
Bottom intercooler, in/out, °F.	83/80	82/80
Bottom tray, °F.	100	90
Rates:		
Wet gas, M.c.f./day	11,600	1,690
Dry gas, M.c.f./day	7,200	630
Lean oil, gal./min.	380	120
Lean oil/dry gas, gal./M.c.f.	76	270
Propane abs. factor	1.21	1.21

TABLE 3—RICH OIL FRACTIONATOR OPERATING CONDITIONS, REFINERY GAS PLANT
(80 per cent propane extraction)

Reflux. accum. pressure, lb.	115
Tower pressure, lb.	120
Feed rate, gal./min.	680
Top product rate, gal./min.	80
Reflux rate, gal./min.	160
Reflux ratio	2/1
Top temperature, °F.	200
Bottom temperature, °F.	520
Bottoms circulation, gal./min.	500
Heat load, M²B.t.u./hr.	20
Lean Oil	
Gravity, °A.P.I.	45
Initial, °F.	275
10 per cent, °F.	280
50 per cent, °F.	320
90 per cent, °F.	370
End point	450
V.P. 10 mm. of Hg. at 100° F.	

Where every drop is precious....



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lation of Drickamer & Bradford* for our lean oil viscosity at operating conditions of one centipoise.

The rich-oil fractionator has a 7-ft. rectifying section with 15 single crossflow bubble trays. The stripping section is a 9-ft. 6-in. tower equipped with 15 double crossflow bubble trays.

Operating Conditions

Table 2 lists the operating conditions that prevail at the high-pressure and low-pressure absorbers for an 80 per cent extraction. The 120-lb. high-pressure absorber requires a lean oil to dry gas ratio of 76 gal./M.c.f. in order to provide the required propane absorption factor of 1.21. The 35-lb. low-pressure absorber requires a ratio of 270 gal./M.c.f. for the same propane absorption factor. It will be noted that at these high oil rates the intercoolers provide only a relatively small amount of intercooling.

Table 3 lists the operating conditions for the rich-oil fractionator under 80 per cent propane extraction. The reflux accumulator is operated at 115 lb. and at about 80° F. to 100° F. The tower itself rides directly on the reflux accumulator pressure and the tower pressure runs approximately 120 lb. The tower is operated with a reflux ratio of about 2 to 1 on the top product. With a bottom temperature of 520° F. the vapor pressure of the resulting lean oil is about 10 mm. of mercury at 100° F. This vapor pressure is somewhat higher than that normally desired for natural-gas operations where the equilibrium oil loss in large dry gas volumes becomes appreciable. In order to obtain the 520° F. at the bottom of the tower, the furnace outlet runs 550° F. which is the maximum to which we wish to go so as to avoid any appreciable cracking. To obtain a lean-oil vapor pressure of about 4 mm. of mercury the tower pressure with the bottom temperature held at 520° F., would have to be reduced to about 75 lb. This would be feasible in a natural-gasoline plant with its lower-vapor-pressure extract. At our plant the high volatility of the extract requires a high operating pressure and the consequently high lean-oil vapor pressure with its resultant small loss. The analyses of our dry gases which are performed on a mass spectrometer occasionally show traces of heavy ends.

Because of the higher pressures employed at the reflux accumulator and the rich-oil vent tank the intermediate flash vapors are kept to a reasonable size. They are, however, sufficient to very effectively remove the greater portion of the ethane and lighter constituents from the extract. The volumes and compositions of the three plant flashes, that is, the low-pressure absorber flash, the rich-oil vent flash, and the reflux accumulator flash, are tabulated in Table 4. The deviation in Fig. 1 of the plant extraction curve from the four theoretical plate extraction curve illustrates the effectiveness of these flashes in removing the light constituents from the extract. Of course some sacrifice is made in the propane and isobutane extract to attain these separations.

Application to Natural-Gas Extractions

This discussion has to some extent illustrated the similarity of refinery absorption plants and natural-gas absorption plants. On the other hand the reader has perhaps gathered that the principal difference between the two rests on the fact that our extract is much more volatile than natural gasoline. Consequently, a high-pressure level must be used in the flash system so as to still retain the bulk of the extract with flashing off the undesirable light components. In natural-gasoline plants where the extract can contain in the neighborhood of 50 per cent of pentanes and heavier, the flash pressures must be commensurately reduced in order to effect the removal of the light constituents.

Table 6 summarizes the results obtained in a natural-gasoline plant which attained a 77 per cent propane extraction. This plant was of a design similar to the plant employed at the refinery and was operated similarly with the following exceptions:

The rich-oil vent tank was operated at 5 lb. The gasoline-oil separator in this plant was a 35-lb. lean-oil stripper equipped with a refluxing rectifying section. In addition, better than 50 per cent of the gasoline production was compression condensate which was added to the system principally as reflux to the still.

The high propane extraction in this plant was made possible, despite the fact that the rundown accumulator was operated at only 35 lb., principally because of the heavy nature of the gasoline extract. This 77 per cent propane extraction showed an increase in yields of propane and heavier components of 2,600 gal. per day above that obtained when aiming at about 47 per cent propane extraction.

For gasolines that lie in the range between this heavy natural gasoline and the light refinery extract, high propane extraction may be obtained by increasing the pressure on the rundown accumulator and rich-oil vent tank commensurately with the volatility of the product. This increased rundown accumulator pressure may be attained either by increasing the still pressure or by an after compression of the reflux accumulator vapors.

TABLE 4—INTERMEDIATE FLASHES, REFINERY GAS PLANT
(80 per cent propane extraction)

Constituent—	Flash vapors, mol. %— L.P. absorber	Rich oil vent	Reflux accumulator
Hydrogen	...	...	...
Nitrogen	...	...	...
Methane	15.2	4.5	0.8
Ethene	4.8	4.2	1.0
Hydrogen sulfide	4.7	4.3	3.0
Ethane	19.5	16.8	14.0
Propene	15.7	20.2	21.5
Propane	30.5	39.1	43.7
Isobutane	4.4	5.2	7.0
Butenes	2.7	2.8	4.6
n-Butane	2.2	2.3	3.8
Isopentane	0.1	0.2	0.2
Pentenes	0.1	0.2	0.2
n-Pentane	0.1	0.2	0.2
Total	100.0	100.0	100.0
Volume, M.c.f. per day	790	600	900

TABLE 5—REFINERY GAS PLANT, TOWER SUMMARY

	High-press. absorber	Low-press. absorber	Rich oil fractionator— Rectifying section	Stripping section
Tower diameter, ft.	6	5	7	9½
Tower height, ft.	72	72	...	83
Design pressure, lb.	150	100	...	150
Number of trays	26	26	15	15
Tray spacing, ft.	2	2	2	2
Type tray	Single Crossflow	Single Crossflow	Single Crossflow	Double Crossflow
Intercooler boots	2	2	...	...
Downflow area, sq. ft.	2.7	2.64	4.35	12.8
Weir length, in.	47	44	59	162

TABLE 6—WET GAS AND PRODUCTS, NATURAL-GAS PLANT
(77 per cent propane extraction)

Constituent—	Wet gas, mol. %	Absorption factor	Per cent extracted	Extract liq., %	Dry gas, mol. %
Carbon dioxide	1.4	...			2.1
Methane	58.6	0.045	0.1	0.1	85.2
Ethane	7.1	0.38	6.5	1.0	9.6
Propane	9.0	1.23	77.0	17.8	3.1
Isobutane	2.8	2.96	98.8	8.0	0.04
n-Butane	5.6	4.13	100.0	16.2	..
Pentanes +	15.5	...	100.0	56.9	..
Total	100.0			100.0	100.0
Volume	3,500 M.c.f./day			38,000 gal./day	2,400 M.c.f./day

*Drickamer & Bradford, "Over-all Plate Efficiency of Commercial Fractionating Columns as a Function of Viscosity," Petroleum Refiner, Vol. 22, No. 10, 1943, pp. 105-110.

TRINITY DRILLING COMPANY

KIRBY BUILDING

DALLAS, TEXAS

August 12, 1941

Franks Manufacturing Corporation
Tulsa, Oklahoma

Gentlemen:

We have used one of your 84-foot telescoping derrick servicing units for a year and wish to inform you of the excellent results obtained and the consequent savings.

The first 12 months we had this unit, it worked on 58 wells. Sixteen of these wells were clean-out jobs and comparable to wells which have taken competitive units from two weeks to a month to complete. Eleven of these wells were deepening jobs - anywhere from 500 to 1,500 feet. Ten were following up rotaries, in this case saving 40 days drilling time on two rotaries. The other jobs were tubing, running and resetting packers.

TRINITY DRILLING COMPANY

KIRBY BUILDING

DALLAS, TEXAS

April 3, 1944

Franks Manufacturing Corporation
Drawer 3218, Whittier Station
Tulsa, Oklahoma

Gentlemen:

We have been using your 5000 Double Drum all-purpose Servicing Unit in combination with your Telescoping Derrick for drilling in Southwest Texas. We have drilled a number of wells 5,000 feet, cutting 7-7/8" size hole. We were averaging one of these wells each 15 days.

We have written you before of other satisfactory service this unit has rendered.

Yours very truly,

President

CWD/mw

DRILLING 5000 FT. WELL EVERY 15 DAYS

WITH FRANKS *ALL-SERVICE* UNIT—

Franks double drum unit such as used by Trinity Drilling Company is specifically designed and built to provide ALL-SERVICE adaptability in a single unit. It will:

1. Drill, with Spudder, from grass roots to 3,500 ft. 2. Drill, with Rotary, from grass roots to 5,000 ft. (with independent driven pump). 3. Pull rods and tubing to 8,500 ft. 4. Drill-in wells to 7,500 ft. depth. 5. Rotary clean-out and deepen to 7,500 ft. 6. Spudder clean-out and deepen to 7,000 ft.

Franks also has other models for varying capacities desired. See one of our representatives or write for complete specifications.

Franks Representatives

Export: A. V. Simonson, 149 Broadway, New York, N. Y.

California: Hillman-Kelley, Inc., 1000 Macy Street, Los Angeles.

Oklahoma and Kansas: W. R. Brown, Box 3218, Tulsa.

Texas, Louisiana, New Mexico: R. M. White, 823 Neil P. Anderson Bldg., Fort Worth, Tex.

Fischer-Tropsch Synthesis May Prove A Major Refining Process

PART 3—CATALYSTS AND THEIR PREPARATION

by Arch L. Foster

Metals of the iron group, Periodic System, including iron, cobalt and nickel, with or without admixture with "promoters" such as alkali metal oxides, alkline earth metal oxides, etc., are the most widely used catalysts for the Fischer-Tropsch synthesis. Iron-group metal salts or oxides are reduced by CO or by hydrogen at elevated temperatures to form the finely divided catalyst. Powdered metal catalysts are supported on relatively inert refractory or other materials such as kieselguhr and processed clays, prepared by, for example, precipitating a hydroxide or oxide of the metal from solution on the supporting material, drying and reducing the supported metal. Some prepared catalysts contain several metals, for example one composed of cobalt with minor amounts of thoria, uranium oxide and copper. Alkali metal oxides and oxides or sulfides of chromium, tungsten, copper, uranium, aluminum and manganese are also claimed as promoters. Sintering the metal is claimed to improve its activity.

IN the ever-growing field of catalysis as it deals with petroleum and hydrocarbons in general, two all-important factors determine the results obtained. These two factors are (1) operating conditions, that is, temperatures, pressures, contact times, physical and chemical condition of charge stocks, impurities, contact conditions, and (2) catalysts, their efficacy for any given job, their life span rate of loss of efficiency, etc.

The main constituent of most catalysts for carrying out the Fischer-Tropsch synthesis is one or more metals from the Eighth Group of the Periodic Table, usually in metallic form. These catalysts may be subdivided physically in almost any practicable manner, although precipitation on a carrier such as kieselguhr (diatomaceous earth) with subsequent reduction is one of the methods most approved in the literature. For example a German patent (3-1) designates a synthesis method for treating CO and H_2 with a catalyst composed of a fused iron oxide, Fe_3O_4, sometimes called "ferroso-ferric oxide," which has been treated with molecular hydrogen at 1,300° C. (2,372° F.), or reducing temperature. Small amounts of titanium or silicon or compounds of these metals are added to the catalyst, presumably as promoters.

An interesting routine for preparing a catalyst claimed to be effective is to reduce the oxide or salt of iron or cobalt, etc., then "passivate" it by treating with CO_2 gas at room temperature over long periods followed by "oxidation" with air at room temperature, "keeping the temperature rise to 3-7° C." (3-2). In carrying out the synthesis of "benzine" a catalyst was used composed of cobalt, copper, and manganese, which was precipitated on kieselguhr with caustic potash (3-5). The authors claimed in this particular synthesis to have obtained 204 cc. of "naphtha" per cubic meter of charge gases, a value higher than that reported earlier as the maximum theoretical yield obtainable. A catalyst of similar composition, obtained by igniting the nitrates of the same metals showed much lower efficiency. In a two-step operation with the better catalyst 160 cc. of product per cubic meter of gas was reported, operating at 100-120 cu. ft. per hour space velocity.

A supported catalyst is made (3-6) by impregnating kieselguhr with five parts nickel, one part manganese, 10 per cent aluminum oxide. The degree of washing of the catalyst after precipitation affected its efficiency strongly, the more washing, generally the better catalyst. Separation of iron and the ignition of the catalyst is not always necessary. The language of many patents is somewhat obscure; one patent (3-8) claims the formation of an effective catalyst by precipitating cobalt, nickel or iron from their salts and applying the oxides formed to diatomaceous earth under conditions which "prevent the deposition of the solubles present on the carrier," presumably in a dilute dispersion with heavy washing to remove the alkalies.

Precipitated Catalysts

An unusual routine given in a French procedure is a method for a Fischer-Tropsch synthesis (3-15) in which the catalyst is made by reducing a metal of the Eighth Periodic Group, precipitated from a solution of its salt, at a temperature below 500° C. (932° F.), then heating the finely divided metal in an inert atmosphere to above 600° C. (1,112° F.) to "agglutinate the catalyst." Presumably this heating in an inert atmosphere puts the catalyst into a surface condition conducive to high efficiency in effecting the synthesis.

In preparing a Dutch version of a catalyst, diatomaceous earth (kieselguhr) fire brick, etc., is rendered insoluble in the alkali by prior heating, by treatment with alkalies or by shortening greatly the precipitation time. Before precipitation of the metal on the carrier from a solution of its salt by alkalies, the carrier is dried at 600°-700° C. (932°-1,112° F.), and then calcined at 1,000°-1,100° C. (1,832°-2,012° F.) which reduces its solubility, in the case of kieselguhr, to one-fifth of that of the uncalcined material (3-16).

A carefully worked-out method for forming a carbon monoxide reducing catalyst is that (3-17) of precipitating equimolar amounts of iron and copper nitrates with caustic soda—NaOH—washing the precipitate to a pH of 7.4; this washed product is mixed with 2 per cent by weight of potassium carbonate, K_2CO_3, dried, and the heavy metal oxides are reduced with hydrogen at 250° C. (482° F.). The synthesis is carried out with this catalyst acting on a 1:1.75 mixture of CO and H_2. A catalyst so made but with less copper is very active, but loses efficiency more rapidly. However, it

is claimed that to omit the potassium carbonate increases the activity. Powdering the catalyst to obtain a finely divided product gives a catalyst of poor activity, and so does precipitation of the oxide with ammonium hydroxide instead of with caustic soda. An interesting observation is that oxidation of the catalyst metal, after its initial reduction with hydrogen, does not affect its activity. It is also reported that X-ray examination of such catalysts shows that no free iron is present in the catalyst after use, but only Fe_2O_3 or Fe_3O_4.

A Japanese researcher reports the successful use of catalysts of the two following general compositions: (1) Cobalt, 8 parts; copper, 1 part; thorium, 0.3 part; (2) cobalt, 9 parts; copper, 1 part; and thoria (thorium dioxide) 2 parts. These catalysts were used to treat gases of the following compositions: 33 per cent CO, 64 per cent H_2, and 32.7 per cent CO and 64.5 per cent H_2. Yields of 50 to 115 g. of hydrocarbons were obtained per cubic meter of gas, at temperatures of 197°-228° C. (386.6°-442.4° F.). The higher the temperature employed the higher the yield of gasoline hydrocarbons, this investigator found (3-19). Nickel catalysts for hydrogenating CO have also been made (3-20) of nickel metal finely divided, with small amounts of promoters such as thorium oxide ThO_2, alumina, Al_2O_3, on fuller's earth; other activators are chromium, molybdenum, tungsten, and uranium sulfide. A catalyst composed of Ni, 15 per cent Mn and 0.5 per cent Cu has shown excellent results, it is claimed.

Control Catalyst Physical Condition

The physical condition of a catalyst is as important as its chemical composition, it has been determined. In that connection a catalyst (3-24) composed of Co 8 parts, Cu 1 part, ThO_2 0.15 part, U 0.15 part, mixed with and supported on an equal amount of kieselguhr has shown excellent results. Another combination (3-25), an Eighth Group metal such as iron is precipitated from solution as the hydroxide, $Fe(OH)_3$, a compound which is reducible with hydrogen; a metal hydroxide which is not so reducible below 900° C. (1,652° F.) is added, such as $Al(OH)_3$, but which is reducible to its oxide by heating. This mixture is heated in a "reducing gas," that is, presumably, a gas containing large percentages of hydrogen, to temperatures above 500° C. (932° F.), to produce sintering. From other discussion and data available the step of sintering the catalyst after or during reduction and as a final conditioning step seems to be a very important factor in the efficiency of these hydrogenating - polymerizing catalysts. The influence of the addition of alumina, silver, and other activators is also discussed in a recent article (3-26).

A recent patent (3-30) outlines the method of preparation of a catalyst mass for the Fischer-Tropsch synthesis; cobalt is dissolved in an aqueous solution of HNO_3, nitric acid; thorium dioxide is formed by precipitating it from a solution of the sulfate with ammonia, NH_3, and dissolving in nitric acid to form thorium nitrate; the solutions of these two nitrates are agitated with kieselguhr, and their carbonates are precipitated by treatment with alkali carbonates, on the kieselguhr. The kieselguhr metal carbonates mass is dried, heated to reduce the carbonates to the oxides, then heated in a stream of hydrogen to reduce the cobalt but not the thorium to the metal.

Metal Carbonyls

In another method (3-32) CO, carbon monoxide, is passed over finely divided iron, cobalt or nickel to form the metal carbonyl, which is added to a inert liquid oil and heated to about 200° F. to decompose the carbonyl and to form a dispersion in the oil a very finely comminuted metal, which dispersion is mixed with the reaction gases, CO and H_2, to effect the synthesis of hydrocarbons. Still another use of the metal carbonyl complex (3-29) introduces a mixture of CO and H_2 into a reaction chamber, the walls of which are composed of or lined with the catalyst metal, presumably in sheet or solid form. At various regular intervals a carbonyl of the metal is introduced to further catalyze the reaction, the carbonyl being decomposed at the temperature of the reaction chamber. This idea may be employed with advantage, it is claimed, when the yield of hydrocarbons from the reaction is lowered for any reason.

Referring again to the sintering of a metal catalyst (3-36), an oxide of an iron Eighth Group metal is reduced in a hydrogen containing gas at a temperature below 500° C. (932° F.), and is then sintered in "the absence of an oxidizing gas" at a temperature below the melting point of the metal. A mixture of CO and hydrogen is reacted in contact with this catalyst at 150°-450° F. Also (3-37), a mixture of these gases forms hydrocarbons with a catalyst of sintered iron with which is combined a small amount of an alkali salt such as potassium chloride, KCl.

Another method for carrying out the reaction with adequate provision for controlling the temperature of the exothermic reaction (3-38) is by treatment of CO + H_2 gas mixtures in the presence of a catalyst composed of 85 Co, 15 ThO_2, 85 kieselguhr disposed in narrow tubes which are submerged in a cooling medium, presumably a circulatory system for carrying away excess heat regularly under controlled conditions.

The physical condition of the catalyst is emphasized especially in two recent patents (3-41; 2-76). A catalyst composed of iron or cobalt metal, or a mixture of the two, or of other similar-type metals is formed by precipitating very slowly from solution the oxides of the metals involved, using 3 to 12 hours to complete the precipitation and coagulation of the metal at temperatures below 40°-30° C. (102°-86° F.), and with a pH value of the solution of 8 or higher. Such a catalyst is used to produce "low-boiling hydrocarbons" from CO + H_2 gas mixtures at 160°-250° C. (320°-482° F.) and two atmospheres; high-boiling and solid products are formed similarly at 75 to 750 p.s.i. according to the inventors.

Like many important chemical syntheses and other industrial processes, the control of operating conditions and of catalyst preparation and condition are at present vital to the successful commercial development of the Fischer-Tropsch synthesis in this and other countries. Several laboratories in this country and England are working hard at developing a commercial process using this reaction as its basis. No exact data are available to show how or under what cost or price conditions this synthesis can compete economically with crude petroleum and its products. However, recent estimates place the cost of production and supply of hydrocarbons by this method at "5 cents per gallon above present costs for gasoline from crude petroleum" (3-43).

While so far as is known no commercial process operating on the Fischer-Tropsch reaction is a going concern outside Central Europe, and Japan, it has supplied considerable amounts of vital material to Germany especially as mentioned above. Every reason exists to believe that production of Kogasin in Germany had increased greatly beyond the 1939 figures (3-44) before military destruction curtailed it to its probable present value, whatever that may be.

Bibliography—Part 3

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3-4. D. R. Pat. 710,963, Nickel Catalyst.

3-5. Catalysts for Benzine Synthesis; Chem. Zentr. 1942, II, 971.

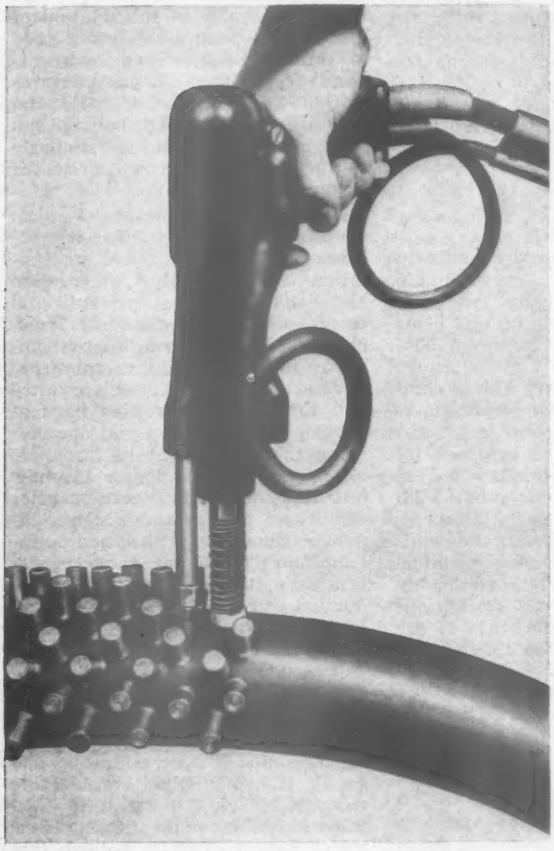
3-6. Catalyst Carrier, Chem. Zentr. 1942, II, 642.

3-7. U. S. Pat. 2,259,961, Reactivation of Catalyst.

3-8. U. S. Pat. 2,261,184, Catalyst Preparation.

(Continued on page 91)

End-weld studs automatically for boiler repair and lagging!



Studs are welded 1¼" apart on 19° centers. The studs are placed in the chuck of the gun, a porcelain ferrule placed on, and the trigger pulled. An arc is created which automatically welds the stud. Complete fusion of the stud to tube is the result—*in less than ½ second!*

This is the stud used on the boiler tubes. It is a Nelson "Flux-filled" ½" diameter stud. These studs are manufactured in many diameters and lengths.

The Nelson Stud Welder automatically end-welds in less than ½ second!

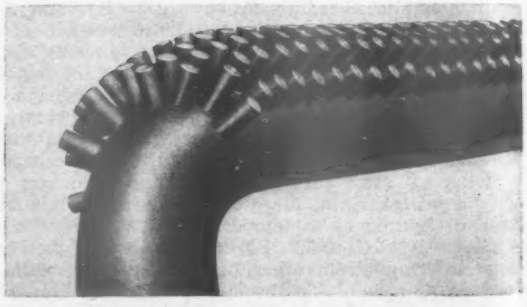
The Nelson Stud Welder is a tried and proven welding tool. Proven by five years actual usage it is today used in more than 400 industrial plants. It is the one means of automatically end-welding studs to metal *right in your own plant.*

Here are typical examples of time and material saved by its use. Two women welders recently welded 13,000 studs on boiler tubes in 18 hours. One welder and helper studded an average of 24 feet or 2300 studs in 8 hours. These are not special tests but checks made on regular jobs.

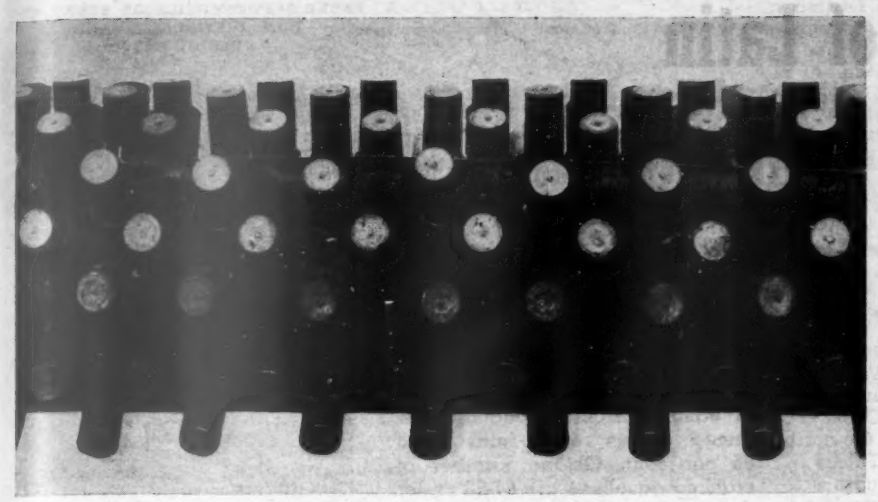
For boiler maintenance or lagging of tanks, storage bins, etc., this stud welder will answer your problems. Excellent for general maintenance, too. It is completely portable and may be easily operated by anyone. *No experience necessary!*

FREE CATALOG & SAMPLES!

Complete information about how you can use the Nelson Stud Welder in your refinery is available to you at no obligation. Simply address a letter to us and we will send you complete details. Address your request for information to:

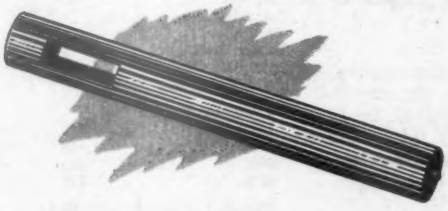


Complete fusion results from the timing and full shielding of the arc. The strength of the weld is stronger than the strength of the steel of the stud. No previous welding experience necessary to do welding of this type.



Close-up view shows alignment of the studs on the tubes. The uniformity of the weld gives satisfactory results and a strong, easily accomplished job.

LAGGING MAGNESIA BLOCKS

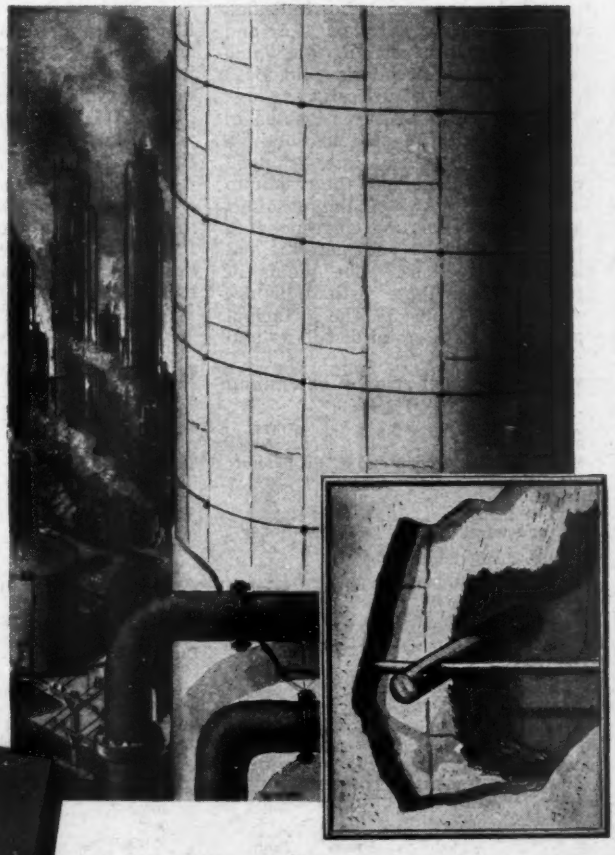


The Nelson Lagging Stud has been especially developed for securing magnesia blocks to heat exchangers, storage bins, tanks, etc. Rapidly welded into position they hold the blocks securely to the metal. Plastered over, the heads act as reinforcing. To save both time and material in this important operation use the Nelson Lagging Stud. *Write today for complete information to:*

NELSON SPECIALTY WELDING EQUIPMENT CORP.

Dept. 41, 440 Peralta Avenue, San Leandro, Calif.

Eastern Representative: Camden Stud Welding Corp. Dept. 122, 1416 South Sixth St., Camden, N. J.



NELSON STUD WELDERS

The studs are welded in rows to the tower. Wire is run through the slots and left slack. The magnesia blocks are slipped under into position and the wire tightened down to secure them. The entire unit is then covered with plaster to complete the work.

Cracking of Latin American Crude Oils

*by Gustav Egloff**

4.—CUMAREBO

Cumarebo crude here discussed is low in sulfur, contains 50 per cent straightrun gasoline of above 50-octane number A.S.T.M. Yields of gasoline from topped and reduced crudes range from 50 to 65 per cent. Octane number of cracked gasolines are 61-63 under the conditions mentioned. By reforming with yields of 83-86 per cent of the naphtha charged, the 52-56-octane number of straightrun gasoline may be upped to 61-70 A.S.T.M.

THERE are several oil-producing districts in western Venezuela which are not properly part of the Lake Maracaibo area. The Cumarebo field which is located near the north seacoast in the state of Falcon is one of these areas. The crudes produced from this field are paraffinic, and have A.P.I. gravities around 50, with correspondingly high gasoline contents. In 1941 the output of the Cumarebo district was 2,069,285 bbl.†

The properties of a Cumarebo crude are shown in Table 1, its paraffinic character being indicated by the A.P.I. gravity of 47.5, and the cold test of 30° F., at which temperature the crude is solid. Both sulfur content and viscosity are low.

The crude oil was fractionated in a semicommercial still to obtain a 392° F. end-point gasoline, a topped crude corresponding to the residuum after the removal of the gasoline, and a reduced crude corresponding to the removal of both gasoline and kerosene fractions. The yields of products from these distillations are shown in Table 2. The principal properties of the total distillates and the residua produced in the topping and reducing distillations are shown in Table 3. The two residual fractions are characterized by relatively high A.P.I. gravities, low viscosities and sulfur contents, and high solidification temperatures.

The topped and the reduced crudes were cracked in a pilot plant to produce maximum yields of 392° F. end-point gasolines of high antiknock properties and residua conforming to No. 6 A.S.T.M. fuel-oil

TABLE 1—PROPERTIES OF CUMAREBO CRUDE OIL

Gravity, °A.P.I.	47.5
Specific gravity	0.7905
Flash (Cleveland open cup)	Room temp.
Viscosity, Furol at 77° F., sec.	11
Sulfur, %	0.11
Cold test, °F.	30
B.s. and w., %	0.2
100 ml. distillation:	
I.b.p., °F.	122
10%	198
50%	406
90%	698
95%	760
Distilled over, %	97.5
Bottoms and coke, %	1.1
Loss, %	1.1
Distilled at 400° F., %	49.0

TABLE 2—DISTILLATION OF CRUDE OIL TO PRODUCE TOPPED AND REDUCED CRUDES

Product—	Yield, Vol. % From topping	From reducing
Gasoline	50.9	....
Gasoline plus kerosene	....	77.0
Topped crude	48.9	....
Reduced crude	....	23.0

TABLE 3—PROPERTIES OF STRAIGHTRUN DISTILLATES AND RESIDUUMS

	Gasoline*	Total distillate†
Distillate:		
Gravity, °A.P.I.	62.7	54.6
Color, °Saybolt	25	...
Doctor test	Neg.	..
Sulfur, %	0.02	...
Octane No.:		
(A.S.T.M.)	54	..
(Research)	54	..
100 ml. A.S.T.M. distillation:		
I.b.p., °F.	104	115
10%	150	178
50%	246	319
90%	356	506
E.b.p.	394	544
Distilled over, %	96.0	96.5
Bottoms, %	1.0	1.5
Loss, %	3.0	2.0
Residuum:		
Gravity, °A.P.I.	35.4	29.1
Flash (Cleveland open cup), °F.	170	245
Fire (Cleveland open cup), °F.	205	300
Flash (Pensky Martens), °F.	145	185
Viscosity, Furol at 77° F., sec.	11	...
Viscosity, Furol at 122° F., sec.	...	12
Sulfur, %	0.15	0.17
Cold test, °F.	65	75
B.s. and w., %	0.2	0.2
100 ml. distillation:		
I.b.p., °F.	378	446
10%	446	569
50%	550	661
90%	748	...
Distilled over, %	99.0	96.5
Distilled at 400° F., %	3.0	..
Distilled at 437° F., %	8.0	..
Distilled at 572° F., %	57.0	11.5
Coke, wt. %	1.3	1.8

*From topping crude. †In reducing crude (gasoline and kerosene).

TABLE 4—CRACKING YIELDS

Charging stock→	Topped crude 1	Topped crude 2	Reduced crude
Yields, % of charging stock:			
Gasoline	62.7	64.9	54.0
Residuum	20.4	19.5	28.6
Gas and loss	16.9	15.8	17.4
Yields, % of crude oil:			
Straightrun gasoline	50.9	50.9	50.9
Cracked gasoline	30.6	31.8	12.4
Total gasoline	81.5	82.7	63.3
Kerosene			26.1
Residuum	10.0	9.5	6.6
Gas and loss	8.5	7.8	4.0
Gas, cu. ft./bbl.	701	769	650

TABLE 5—PROPERTIES OF UNTREATED CRACKED GASOLINES AND RESIDUUMS

	From topped crude 1	From topped crude 2	From reduced crude
Untreated gasoline:			
Gravity, °A.P.I.	62.0	61.0	62.9
Gum, mg./100 ml. (copper dish)	....	123	251
Sulfur, %	...	0.03	0.03
Octane No. (A.S.T.M.)	61	61	63
Octane No. (Research)	70	70	69
100 ml. A.S.T.M. distillation:			
I.b.p., °F.	96	100	102
10%	142	148	143
50%	252	264	250
90%	348	376	352
E.b.p.	384	394	392
Residuum:			
Gravity, °A.P.I.	4.8	0.5	3.5
Flash (Cleveland open cup), °F.	260	...	285
Fire (Cleveland open cup), °F.	325	...	345
Flash (Pensky-Martens), °F.	145	...	135
Viscosity, Furol at 122° F., seconds	52	162	208
Cold test, °F.	35	...	60
B.s. and w., %	0.4	0.5	1.0
I.b.p., °F.	456	...	474
% at 572° F.	7.5	...	6.0

*Director of research, Universal Oil Products Co.

†O'Donnell, J. P., The Oil and Gas Journal 40. 44. 34 (1942).

TABLE 6—TREATMENT OF CRACKED GASOLINES

	From topped crude		From reduced crude	
Untreated gasoline, vol % charging stock	...	64.9	...	54
Treatment	None	Acid	None	Acid
Acid, lb./bbl.		2		2
Acid solution loss, %		1.0		0.9
Polymerization loss, %		0.5		0.5
Distillation loss, %		3.4		1.7
Total loss, %		4.9		3.1
Treated gasoline, % of:				
Raw gasoline		97.0		97.3
Charging stock		63.0		52.5
Crude oil		30.8		12.1
Gravity, °A.P.I.	61.0	58.4	62.9	60.5
Vapor pressure (Reid), p.s.i.		3.0		3.5
Color, °Saybolt	6	27	Yellow	30
Color stability*		23		29
Doctor test		Neg.		Neg.
Gum, mg./100 ml. (copper dish):				
Without inhibitor	123	13	251	32
With inhibitor No. 1, (0.025%)	13	8	111	5
Oxygen bomb stability, induction period, min.:				
Without inhibitor	330	420	580	540
With inhibitor No. 1, (0.025%)	450	850	675	910
Sulfur, %	0.03	0.03		0.03
Octane No. (A.S.T.M.)	61	59	65	60
Octane No. (Research)	70	65	69	66
100 ml. A.S.T.M. distillation:				
I.b.p., °F.	100	114	102	115
10%	148	156	145	154
50%	264	262	250	246
90%	376	360	352	340
E.b.p.	394	394	392	380
Distilled over, %		98.0		97.0
Bottoms, %		1.0		1.0
Loss, %		1.0		2.0

*After exposure to equivalent of 2 hours noon June sunlight.

TABLE 7—PROPERTIES OF CUMAREBO STRAIGHTRUN GASOLINES

E.b.p., °F.	350	400	425
Volume % of crude	43.2	52.1	54.3
Gravity, °A.P.I.	63.4	61.4	60.6
Octane No. (A.S.T.M.)	56	53	52
100 ml. A.S.T.M. distillation:			
I.b.p., °F.	100	120	128
10%	145	158	158
50%	222	242	246
90%	298	344	356
E.b.p.	348	400	425
Distilled over, %	98.0	98.0	98.5
Bottoms, %	1.5	1.5	1.0
Loss, %	0.5	0.5	0.5

specifications. Single-coil recycle operation was employed, and, in the case of the topped crude, runs were made at 300 p.s.i., and transfer temperatures of 925° and 940° F., respectively. The reduced crude was cracked under a pressure of 250 p.s.i. and a transfer temperature of 925° F. The yields of gasoline, residuum, and gas from the cracking runs are shown in Table 4. In the two runs on the topped crude, the higher temperature gave the higher yield of gasoline and the lower gravity residuum. Under the conditions employed, the yield of cracked gasoline from the reduced crude is shown to be considerably less than that obtained from the topped crude. The yields of products based on the original crude are also shown in Table 4, and indicate that the highest total yield of 82.7 per cent of straightrun and cracked gasoline was produced by the high-temperature cracking of the topped crude.

The more important properties of the gasolines and residua produced in the cracking of the topped and reduced crudes respectively are summarized in Table 5. The sulfur contents of the gasolines are low, and the octane numbers are in line with the paraffinic character of the charging stocks. The residue produced in the higher-temperature cracking of the topped crude and in the cracking of the reduced crude have Furol viscosities meeting the No. 6 A.S.T.M. fuel-oil specifications, which require values between 100 and 300 seconds at 122° F. The viscosity of the residuum from the lower-temperature cracking run on the topped crude is lower than requirements. The flash points are well above 150° F.

The cracked gasolines were treated with small amounts of 93 per cent sulfuric acid, neutralized with sodium hydroxide solution, and rerun with fire and steam with a maximum still temperature of 350° F. The conditions of treatment and the yields and properties of the treated products are shown in Table 6. No sweetening was required. The effect on the gum content before and after the addition of U.O.P. inhibitor was also noted. The treatments show that in order to produce gasolines of satisfactory character by acid treatment, an average of about three octane numbers is lost. The gum contents were readily reduced by the inhibitor, and the color stabilities of the treated and rerun gasolines were satisfactory.

A thermal reforming test was conducted on straightrun gasoline produced in topping the Cumarebo crude oil in a semicommercial still. The properties of this gasoline, which represented 50.9 per cent of the crude oil, are given in the first

TABLE 8—THERMAL REFORMING YIELDS

	1	2	3
Yields, % of charging stock:			
Gasoline	86.2	83.0	71.5
Residuum	0.6	2.1	3.6
Gas and loss	13.2	14.9	24.9
Yields, % of crude oil:			
Reformed gasoline	43.8	42.2	36.4
Residuum	0.6	1.4	2.0
Gas and loss	6.7	7.5	12.7
Gas, cu. ft./bbl. charging stock	319	344	693

TABLE 9—PROPERTIES OF REFORMED GASOLINES AND RESIDUUMS

	1	2	3
Untreated gasoline:			
Gravity, °A.P.I.	61.3	63.2	60.2
Gum, mg./100 ml. (copper dish)	...		54
Sulfur, %	...		0.02
Octane No. (A.S.T.M.)	61	66	70
Octane No. (Research)	65	68	75
100 ml. A.S.T.M. distillation:			
I.b.p., °F.	112	101	102
10%	153	146	144
50%	238	235	228
90%	352	350	352
E.b.p.	390	391	401
Residuum:			
Gravity, °A.P.I.	28.2	25.7	19.8
100 ml. distillation:			
I.b.p., °F.	34	371	320
10%	407	420	420
50%	515	515	518
90%	688	700	710
E.b.p.	760	760	754
Distilled over, %	98.0	98.0	98.0
Bottoms and coke, %	1.6	...	2.0
Distilled at 400° F., %	8.0	6.6	5.0
Coke, wt. %	...	2.0	...

Accident Rate at Wood River Refinery Lowered Despite Increased War Construction

***by J. F. Goldsberry** **

THE safety department of the Wood River, Ill., refinery of Shell Oil Co., Inc., is composed of a staff safety chairman, head safety engineer and seven safety inspectors. This organization in collaboration with other departments, assumes the responsibility for all safety instructions and safe working conditions throughout the plant. Safety has always been stressed in the plant and a low accident-frequency record maintained. However, at the beginning of the war when considerable construction activity had already started and accidents were on the increase, it became evident that more activity in safety work was necessary if accidents were to be held in line.

The safety organization started an intensive safety drive, with a firm belief that accidents need not happen in spite of the unusual conditions being experienced. As a result, the safety record has not only been maintained but actually improved. This refinery is now one of the few plants in the petroleum industry in which the accident frequency has been lowered since the start of the war. In this period the refinery safety record has been exceeded twice and a total of 3,205,000 manhours worked with one disabling injury. It may be added that the records are in no way influenced by injured employes returning to what is known as "light duty" to avoid disabling injuries, as the refinery physician's judgment is final in this respect.

The present average accident frequency for the refining industry as reported by the United States Department of Labor is 11.8. In comparison, this refinery's frequency record over the past 5½ years including July 1944 is as folows:

1939	2.51
1940	1.50
1941	3.75
1942	3.39
1943	2.89
1944 (7 mos.)	1.77

Supervision must first become interested and sold on safety, as experience has taught that unless safety thinking starts from the top full benefits will not be reached on the way down. To accomplish this the old maxim "to increase interest, give a person something to do" was employed. Accordingly, all supervisors were given an opportunity to lead meetings.

Fifty Safety Meetings Per Month

Approximately 50 safety meetings are held each month. All maintenance and construction employes attend meetings of 1 hour's duration. In some departments where it is more convenient, small group sessions are held weekly. All employes with the exception of the office workers attend these meetings.

Special attention is given to the subject matter and the method of conducting meetings. A poorly conducted or uninteresting meeting makes little impression on the emploes. The leaders are chosen from the entire refinery staff in accordance with their ability.

In all meetings, safety thinking is stressed and, in particular, near accidents are discussed. The interest of employes is easily held on such subjects. Suggestions are requested but not dwelled on for any length of time as in most instances they require investigation and then are handled personally with the suggester. All suggestions are disposed of as quickly as possile by means of a letter advising of their final disposition. Good housekeeping is not allowed to consume too much time in the meetings. Disabling injuries in the plant are thoroughly aired along with action taken to prevent recurrence. The prime purpose of the meeting is to promote the feeling among the employes that they have a duty in safety work and are, in a sense, all safety inspectors.

Active interest of staff members also stimulates the work of the regular inspectors. These inspectors have been trained so that in promoting safety work they are able to obtain the cooperation of the foreman and employes. They have been carefully chosen and possess years of refinery experience. They are men or good personality and by nature are patient and cooperative. They understand that safety cannot be forced but must be obtained through educating the employes to think and want to do a job safely whether an inspector is around or not.

The safety organization at Shell's Wood River refinery is a division of the engineering department and consists of James F. Goldsberry, refinery chief engineer, as safety chairman; Ray A. Randels, head safety engineer; A. T. Smith, J. S. Brien, G. L. Moorman, Jr., and C. A. Nicolet, senior inspectors, and E. S. Quillen, E. B. Wiley, Jr., and B. C. Cole, inspectors.

Directly responsible for putting into practice the precautions which have made possible the outstanding safety record of Shell Oil Co., Inc.'s, Wood River refinery are the members of the refinery's safety staff: R. A. Randels, B. C. Cole, E. S. Quillen, J. S. Brien, G. L. Moorman, Jr., C. A. Nicolet, J. F. Goldsberry, A. T. Smith, and E. B. Wiley, Jr.

*Chief engineer, Wood River, Ill., refinery Shell Oil Co., Inc.

High-octane flying fuel is being manufactured and stored in enormous quantities in welded pressure vessels made by General American. In every quarter of the globe, military and industrial experts recognize the GATX symbol as signifying quality. GATX-built equipment, backed up by GATX Know-How, can effect production economies for *you!*

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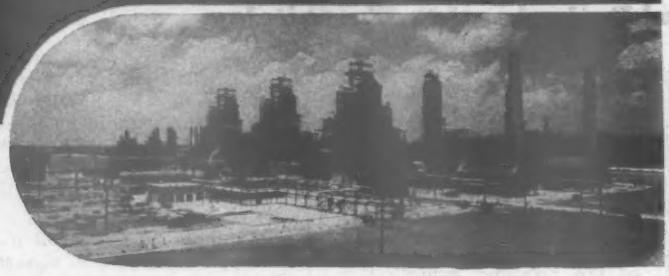

This new 100-octane gasoline and butadiene plant, now operating deasphalting, desalting, topping and cracking units, will produce daily enough high-octane gasoline to power a raid of 1000 bombing planes over Germany. Butadiene for more than 12 million synthetic rubber tires will be turned out each year.

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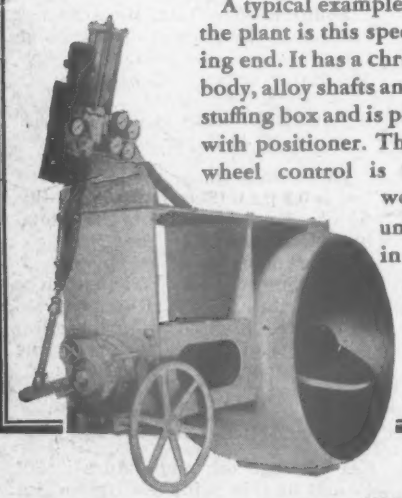

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oil at 159° F. is obtained from a viscosity-temperature chart and is found to be 1.6 centipoises.

At a linear velocity of 3.4 ft. per second, a tube i.d. of 0.495 in., an average oil viscosity of 3.0 centipoises, a viscosity at the tube wall of 1.6 centipoises and an A.P.I. gravity of 38°, the pressure loss as determined by Fig. 1 is found to be 0.07 p.s.i. per foot of tube length.

The total pressure loss through the three exchangers is:

$$\Delta P = 0.6 + 0.07 \times 36 = 3.1 \text{ p.s.i.}$$

Any piping between the exchangers should also be taken into consideration in determining the total pressure loss. In the foregoing example, the linear velocity is somewhat low and more efficient heat-transfer rates could be attained at a higher velocity and a corresponding greater pressure loss.

If preliminary heat-transfer calculations were not available in the foregoing example, the tube-wall temperature could be approximated by assuming that the film resistance on the tube side amounted to about 50 per cent of the total resistance. In this case the calculated tube-wall temperature would be:

$$t_w = 96 + 120/2 = 156° \text{ F.}$$

which is accurate for all practical purposes, since it will give the same pressure loss as the foregoing calculations.

By neglecting the viscosity variation altogether and assuming that the viscosity at the tube wall is the same as the average viscosity, the calculated pressure loss for the three exchangers would be 3.3 p.s.i. which for this particular example is sufficiently accurate.

Notation:

- Re = Reynolds' No. ($Re = d\,u\,\rho/z_a$), dimensionless.
- u = linear velocity of fluid, ft./sec.
- ρ = density of fluid, lb./cu. ft.
- z_a = viscosity at average fluid temperature, lb./ft.-sec.
- z_w = viscosity at tube-wall temperature, lb./ft.-sec.
- d_i = inside diameter of tube, ft.
- f = friction factor, dimensionless.
- ΔP_1 = header-box loss, lb./sq. in.
- ΔP_2 = pressure loss in tubes, lb./sq. in.
- s = specific gravity of fluid at average temperature.
- L = length of tubes, feet.

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PROGRESS IN METALS

by W. L. Nelson
Consulting Engineer

Leaded Manganese-Molybdenum Steel

THIS type of alloy steel as well as other molybdenum steels are among the strongest. The need of the petroleum industry for extreme-strength steels may be assisted by the development of leaded (easy-machining) steels, and hence, the following condensation of "Leaded Manganese - Molybdenum Steel," by T. Swinden in Metallurgia, Vol. 29, pp. 26-30, November 1943, will prove valuable. Perhaps the use of lead can, in time, provide our industry with cheap steels that exhibit tensile strengths of 200,000 to 250,000 p.s.i.

A comprehensive study was made of the comparative mechanical properties, grain size, hardenability and machinability of two ingots of manganese-molybdenum steel, to one of which 0.19 per cent of lead has been added. The chemical analysis of the heat was as follows: 0:35 C, 1.43 Mn, 0.225 Si, 0.032 S, 0.045 P, 0.43 Mo, 0.16 Ni, 0.11 per cent Cr.

The steel was melted in an acid open-hearth furnace, poured into 4,500-lb. big-end-up ingots and rolled into 4½ by ⅝-in. flat bars and 1, ⅞ and ¾-in. rounds.

Lead exudation tests of the slabs showed the steel to be free from lead segregation. Standard Jominy tests showed the nonleaded steel to have a slightly higher hardenability.

Longitudinal and transverse specimens from the flat bars were normalized, oil or water quenched, and tempered. Room temperature tensile and impact tests of these specimens showed little difference in the yield and tensile strength or the elongation or reduction of area between the leaded and nonleaded steels.

This was true of the longitudinal and transverse specimens. Nor was there any difference in these properties between the oil quenched and water-quenched specimens.

All specimens showed yield strengths of approximately 118,000 p.s.i. and tensile strengths of about 125,000 p.s.i. The longitudinal specimens showed elongations of about 25 per cent and reductions of about 60 per cent, while the transverse specimens had elongations of about 17 per cent and reductions of about 35 per cent.

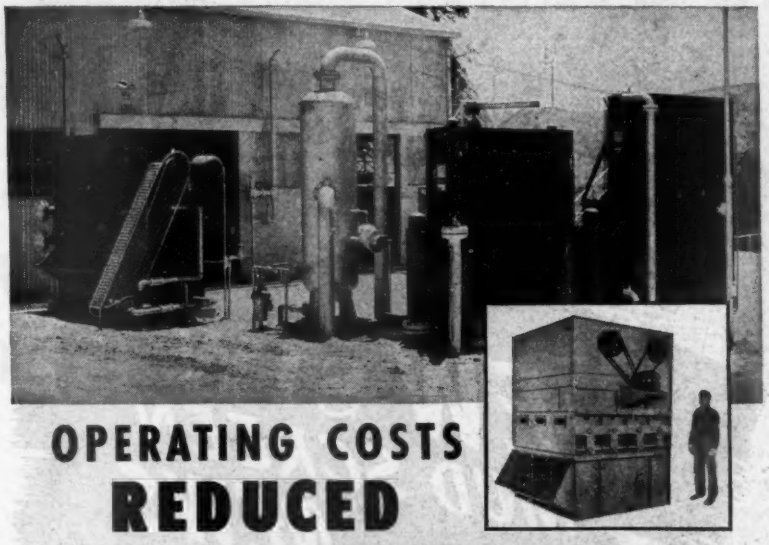
The Izod impact strength of the nonleaded steel was slightly higher in all cases. Tests made on quenched and tempered rounds showed approximately the same tensile strength, yield strength, elongation and reduction of area as the tests on the flat bars.

Izod impact tests of the heat-treated rounds showed the leaded steel to have about 12 ft.-lb. less impact strength than the nonleaded steel.

The modulus of elasticity of the two steels was approximately the same as tensile strengths of 125,000 p.s.i., but at strengths of 147,000 p.s.i. the modulus of the leaded steel was somewhat higher.

Tests at 300°, 350°, 400° and 450° C. (570°, 660°, 750° and 840° F.) on longitudinal and transverse oil-quenched and tempered specimens from the flat bars showed the leaded and nonleaded steels to possess approximately the same tensile strength.

The elongation and reduction of



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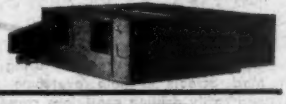

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area of the leaded steel at elevated temperatures were considerably lower than those of the nonleaded steel. The Izod impact strength of the leaded steel was somewhat less than that of the nonleaded steel up to 550° C. (1,020° F.).

Elevated temperature tensile and Izod impact tests of oil-quenched and tempered round bars showed similar results to those for the flat bars. Tests of the damping qualities of the heat-treated leaded and nonleaded steels showed little difference between them.

Fatigue tests showed very slightly higher fatigue ratios for the nonleaded steel. Leading produced an increase of about 38 per cent in the machinability of the steel at both high and low tensile strengths, when tested by the standard Losenhausen machinability test.

The leaded and nonleaded steels had identical Barr-Bardgett creep-stress values at 500° C. (930° F.).

This abstract was taken from the May 1944 issue of Metals & Alloys.

New Alloy Vitally Needed

THE development of some chemical processes by the petroleum industry has been delayed and nearly suppressed by the lack of suitably cheap metallic materials that can be used at temperatures of 1,200° to 1,600° F. Even higher temperatures would be desirable but for the present, alloys that could withstand 1,600° F. would inaugurate almost miraculous developments. High octane gasoline would be available at low cost, butadiene for synthetic rubber could be made in good yield rather than the paltry 4 to 9 per cent necessitated by present low-temperature processes, and the valuable aromatic and olefinic hydrocarbons could be produced in bulk. Heretofore, the petroleum, coal and gas industries have had to depend upon ceramics ware, brickwork and other weak materials when operating at really elevated temperatures. Such materials are unsuitable for most continuous operation because the fluids undergoing chemical reaction cannot be properly confined nor can the chemical process be properly controlled.

Technical and plant men are aware of the need for a really high-temperature metallic material. An item on this page May 6, 1943, entitled "New High-Temperature Alloys of Columbium and Iron," has attracted much attention. This item mentioned experiments by D. W. Dudorff and presented an abstract of his paper in the magazine Metallurgia. He reported that alloys of iron and columbium (not steels) gained in strength up to a temperature of 2,100° F. Iron columbium alloys may not be the answer to the needs of the petroleum refiner, but it does seem that the possibilities of steels (iron and carbides) has been thoroughly explored and that other alloys might be more suitable for high-temperature service. So much of the oil industry's metal usage has centered around steel that little attention has been given to other alloys of iron.

Lubrication in Deep Drawing

THE lubrication of machinery employed in deep-drawing metal-working operations is extremely difficult and complicated. The subject is too large to be discussed here but attention is called to the excellent series of four articles by Crowther, Liddiard & Marwood in Sheet Metal Industries, October, pp. 1,733-1,738; November, pp. 1,915-1,920; December, pp. 2,099-2,105, all in 1943, and January, pp. 81, 83, 88 in 1944. In addition, a lengthy abstract is published on pages 1,468, 1,470, 1,472 and 1,474 of the June 1944 issue of Metals & Alloys.

The general theory of such lubrication, the types of lubricants, the use of metallic soaps and the methods of applying lubricants are discussed.

Reproduction of article appearing in OIL AND GAS JOURNAL, June 24, 1944

Operators in this area are using the SIW Mud Screen to help overcome the slow and costly drilling conditions caused by the hard lime and chert formations, which in some instances wear out bits every ten feet. As reported in this article, the SIW Mud Screen is accomplishing some highly satisfactory results. The SIW Mud Screen has been designed by engineers who know what is required of a mud screen. Ask for complete details if you want better shale removal from your drilling mud.

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Both Mrs. Lois Hand and Mrs. Lola Nelson, casing-machine operators, are working at their first jobs, and are reported to be doing a highly satisfactory job. However, both plan to quit and resume household work when the war is over

More Than 1,000 Women Employed At Continental Oil Co. Refinery

IN less than 2 years the number of women employed at Continental Oil Co.'s Ponca City, Okla., refinery has increased from a few office workers to over 1,000, according to a recent report.

The control laboratory which a little more than 1 year ago had 28 company-trained women employed as testers, now has 60 women handling the testing plus 4 women graduate chemists doing analytical work.

Early in 1943 a contingent of 15 women, the first refinery workers in the history of the company, were employed in the compounding and packaging plant. Various occupations from pickup truck drivers to stencilers are included in those handled by the women working in this department.

Some of the other occupations in the different departments of the manufacturing division in which women are employed include machine-shop crane operators, boiler firemen and engineers' helpers, control-board operators, gagers, loading-rack helpers and cleanup squads. Approximately 300 women regularly report for work on each of the 7 a.m., 3 p.m. and 11 p.m. shifts.

Many of the women employed in the refinery are housewives whose husbands are serving with the armed forces. Some are business women having previously been employed as school teachers, store clerks and waitresses, and others were students. Most of the women workers in the refinery plan to return to their regular activities and occupations after the war.

Fischer-Tropsch Synthesis

(Continued from page 69)

3-9. Br. Pat. 533,459, Regeneration of Catalyst.
3-10. Br. Pat. 534,357, Catalyst Preparation.
3-11. Br. Pat. 534,367, Mixed Metallic Catalyst.
3-12. Br. Pat. 536,767, Catalyst Carrier.
3-13. U. S. Pat. 2,274,639; Br. Pat. 536,912. Precipitated Metal Catalyst.
3-14. Br. Pat. 538,225, Iron-Alkali Metal Catalyst.
3-15. Fr. Pat. 814,636 (Add No. 49,333). "Agglutinated Catalyst."
3-16. Dutch Pat. 50,858, Carriers for Metal Catalyst.
3-17. Iron Catalysts for Hydrogenation of Carbon Monoxide, Ann. Combust. Liq., Vol. 10, 472 (1935).
3-18. Alloy Skeletons for Catalysts, Fischer-Berichte, Vol. 67B.
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3-20. Nickel Catalysts for Benzine Synthesis, J. Soc. Chem. Ind. (Japan), Vol. 36 Sup., 413 (1933).
3-21. See 2-40.
3-22. See 2-41.
3-23. See 2-42.
3-24. Synthesis of Benzine, J. Soc. Chem. Ind. (Japan), Vol. 35, Sup., 179 (1932).
3-25. U. S. Pat. 2,211,022, Preparation of Mixed Metallic Catalysts.
3-26. Benzine Synthesis, J. Soc. Chem. Ind. (Japan), Vol. 43 Sup., 235 (1940).
3-27. Japan. Pat. 134,554, Fischer-Tropsch Synthesis Catalyst.
3-28. See 2-48.
3-29. U. S. Pat. 2,234,568, Catalyst Metal as Chamber Wall.
3-30. U. S. Pat. 2,244,573, Preparation of Catalyst.
3-31. Br. Pat. 516,160, Reactivation of Catalyst.
3-32. U. S. Pat. 2,250,421, Catalysts From Metal Carbonyls.
3-33. Br. Pat. 526,465, Regeneration of Spent Catalyst.
3-34. U. S. Pat. 2,251,554, Regeneration and Use of Catalyst.
3-35. D. R. Pat. 701,846, Solvent Reactivation of Spent Catalyst.
3-36. U. S. Pat. 2,254,748, Sintered Metal Catalyst.
3-37. U. S. Pat. 2,254,806, Sintered Fe Catalyst.
3-38. Br. Pat. 528,617, Temperature Control of Synthesis Temperature.
3-39. U. S. Pat. 2,261,184, Carrier-Supported Metal Catalyst.
3-40. See 2-81.
3-41. U. S. Pat. 2,296,405, Preparation of Catalyst; Precipitation.
3-42. See 2-62.
3-43. Article to be published, by R. E. Wilson, The Oil and Gas Journal.
3-44. Substitute Fuels as a War Economy, Egloff, Chem. Eng. News, Vol. 20, 649 (1942).

Dale H. Rowden, geologist, has resigned as appraisal agent for Republic National Bank of Dallas, to become a consultant.

H. D. Haney has been appointed assistant vice president of Tide Water Associated Oil Co., San Francisco. **Gardiner Blackman** has been appointed manager of industrial relations, succeeding **C. R. Brown,** who assumes additional responsibilities as assistant to the president.

Frederick J. Smith, formerly with the Tennessee Valley Authority, has joined the geological staff of Sinclair Wyoming Oil Co. at Evansville, Ind.

Watson B. Joyes has resigned as exploration manager for Sohio Petroleum Co. at Owensboro, Ky., to return to Tulsa as an independent producer. **Joe Arvin,** engineer for Sohio at Owensboro, has been transferred to Oklahoma City.

Dr. W. I. Wright, with a geological party, is investigating oil prospects on the Minaker River in northern British Columbia and along the Alaska Highway route for Socony-Vacuum Oil Co.

Don D. Montgomery, who was superintendent of production for Murphy Land Co., oil-producing firm, in the El Dorado, Ark., field at the time of his entrance into the Army as a second lieutenant in 1942, has been promoted to captain in the Quartermaster Corps.

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SCHUNDLER

Well-Conditioning Torpedo Employs New Principle

THE Burch agate torpedo is a tool designed for the reconditioning of oil and gas wells through the use of high-velocity explosives in small column as a propellant and solid round pellets laced tightly around the column as projectiles. More specifically stated, this tool is to be used to clean congested porosity on the face of pay sections, to destroy liners, to ream and underream, to clean water and gas floor wells, to knock down the shattered formation interlocked on the irregularities of shot holes, and to reopen parts of formation squeeze jobs within inches. It has been used safely on all such jobs, open and untamped, within inches of liner or casing shoe, whether it be cemented or not.

The fundamental principle which governs the operation of this device is that it harnesses the explosive used so as to drive solids against the wall of the well as projectiles. The effectiveness of a small column of explosive used to drive projectiles is incomparably greater than that of a larger column of explosive which is unharnessed. The efficiency is not increased, however, by using a larger column of explosive to drive the projectiles because the projectiles attain a velocity approximately equal to the speed of detonation of the explosive used, and this is a constant no matter how large the column.

The operation of this torpedo must not be confused with the power effect of bulk shots of explosives; the effect of this tool is to harness the power of the explosive and to direct it through the projectiles to the work to be accomplished. It is the projectiles alone which clean the walls of the well. Glass marbles have been found more effective for projectiles than any other material because of their disposition to disintegrate in the formation with blasting effect.

Over 100 Wells Treated

Over 100 wells have been treated with this torpedo for congested porosity at the pay section. The average increase in production effected in these wells has been in excess of 350 per cent. In reconditioning old wells, it should be recognized that when the face of the pay section has been cleaned back to a point where the porosity is uncongested, nothing more can be done by any method to increase the natural flow of oil from the formation except by pressuring or flooding from input wells on the lease. This tool accomplishes this completely and drops the loosened formation to the bottom of the well where it can be cleaned out by the usual methods. On wells where there is a large amount of formation shattered but interlocked on the walls of the shot hole made by the virgin shot, the clean-out time has been about 3 days; retreatment of the well, however, drops the formation into the hole in a condition so that it can be cleaned out in 1 day or less. The production of gas wells has been increased an average of 90 per cent and the clean-out time is zero. The treatment of gas wells with this tool is particularly efficient.

How It Is Constructed

The torpedo is made of two concentric tubes. The inner tube, 1½ in. in diameter and made of tin, contains the explosive. The other tube, 3 in. in diameter, is made of paper, or, in cases where long submergence is necessary, it may be made of hail screen or tin. The annular space between the tubes is filled with ⅝-in. clear crystal, heat-treated glass marbles, 10 marbles to the ring, 22 rings per linear inch along the torpedo. The loaded weight of the torpedo completely assembled is 4 lb. for each linear foot. This weight permits the running of long columns from the shooter's regular equipment with safety. The torpedo is designed to be run in one rigid column to cover the portion of the hole to be treated at one shot. The torpedo is made in 5-ft. sections, each section having a 5-ft., ⅛-in. explosive container and a 5-ft. marble container. The inner tube is ⅛ in. longer than the marble container so that it will carry all of the column weight. The sole function of the outer tube is to hold the marbles in place tightly against the explosive container. The sections are packed complete with marbles at the factory; the explosive is placed in the torpedo on the job. Sections are connected together by a tin collar 3⅛ in. by 8 in. with a slight crease in the middle which is placed on each section as it is lowered into the hole. The entire column is supported by a 3⅛-in. by 8-in. tapered bottom shoe having two steel eyes at the top to which basket wires are fastened. The first section of the torpedo slips into the shoe to a depth of 4 ft.

Most of the tests made thus far have been for the purpose of cleaning obstructed porosity at the pay section. Tests indicate that it may be used successfully to destroy liners by shredding.

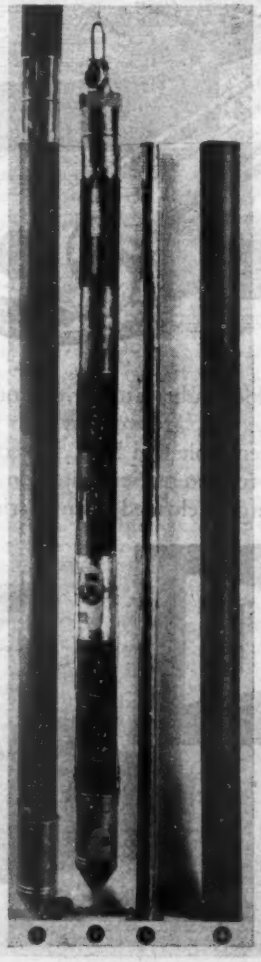
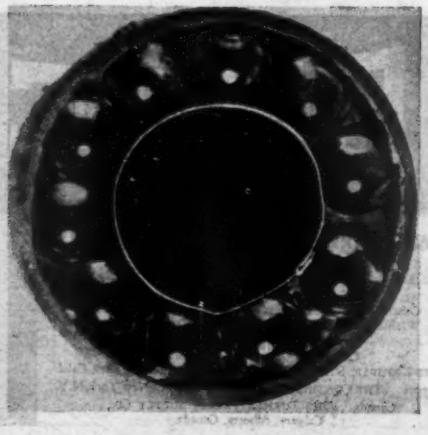


TABLE OF RESULTS OBTAINED ON THE FIRST 12 WELLS TREATED (IN BBL. PER DAY)

Well No.	Production before treatment	Production after torpedo was used
1	0	8
2	2	4
3	4	33
4	0	0
5	4	12
6	6	8
7	4	28
8	5	60
9	6	26
10	18	80
11	22	108
12	4	36

Left: (1) Marble shell container assembly showing saddle and coupling, in 5-ft. section. (2) Cutaway of abbreviated sections. (3) Explosives container. (4) Outer paper tube, marble container

Below: Cross-sectional view of shells and marbles in place, showing inner tin shell (explosives container) and the outer paper marble container



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The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL

Strength of Tanks and Heads

HORIZONTAL cylindrical tanks are most common but there is a tendency to use dome-end vertical cylindrical tanks of somewhat large diameter, often insulated and covered with a second steel shell. Refinery cylindrical storage vessels except high-pressure gas cylinders are of the thin-wall type whose strength can be computed with accuracy. Thin-wall cylinders are ones whose wall thickness is small compared to the diameter of the cylinder so that the wall and ends can bend or adjust themselves to best sustain the internal pressure. The thin-wall formula given here is satisfactory up to pressures of 1,000 p.s.i. and is reasonably reliable for small diameter (24-in.) vessels up to 2,000 p.s.i.

$$P = \frac{2TSE}{100DF} = 27{,}500\,\frac{T}{D}$$

$$T = \frac{100PDF}{2SE} = \frac{PD}{27{,}500}$$

in which:

P = allowable internal pressure, p.s.i.
T = thickness of wall, in.
D = diameter of tanks, in.
F = factor of safety, usually 4
E = joint efficiency, often 100
S = tensile strength, 55,000 for carbon steel

The simplified forms which involve the constant 27,500 are based on S = 55,000, E = 100, and F = 4. Barring mechanical defects, the theoretical bursting pressure of cylindrical vessels will be about four times the pressure given by the above formula. The same formulas may be used for spheres except that a smaller factor of safety may be used. Carefully made welded joints are now considered to be 100 per cent efficient. The efficiency of riveted joints should be computed because they may have efficiencies of 40 per cent or less.

Tank ends.—An ellipse is the best shape for the end of a tank. The higher the pressure the smaller the main radius of the ellipse until at extreme pressure it becomes almost a hemisphere. Our practical ellipse shape is the common dished head shown on this page and having the following dimensions: (1) Radius equal to or smaller than diameter of shell; (2) knuckle connection having radius exceeding 6 per cent of shell diameter; (3) corner welds not permitted (see sketch); (4) weld should be at least four times the plate thickness away from bend of the knuckle; (5) extra strength must be allowed for manholes and openings.

Such heads when extending outward from the ends of a cylinder can be of the same wall thickness as the cylinder but it is common practice to use thicker heads. If the head is convex to the pressure (head extends into the tank) the thickness should be 66⅔ per cent larger but many designers entirely reject this type of construction unless heavily braced. Flat ends are not recommended except for very small diameter cylinders such as pipe ends, etc.:

$$T = D\sqrt{\frac{5CP}{S}}$$

in which the symbols are the same as above and constant C ranges from 0.162 for the worst constructions up to 0.5 for the best. For blind-flange ends the diameter is taken as the bolt circle diameter.

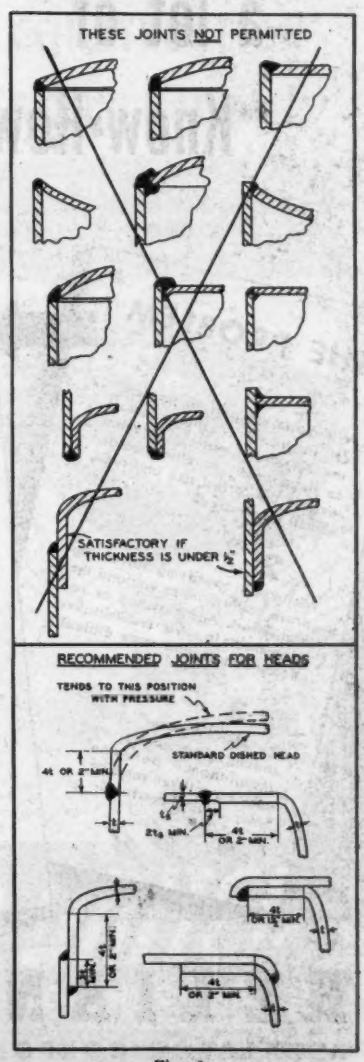
THESE JOINTS NOT PERMITTED
SATISFACTORY IF THICKNESS IS UNDER
RECOMMENDED JOINTS FOR HEADS
TENDS TO THIS POSITION WITH PRESSURE
STANDARD DISHED HEAD
4t OR 2" MIN.
2t MIN.
4t OR 2" MIN.
4t OR 2" MIN.
4t OR 2" MIN.
4t OR 2" MIN.

Fig. 1

WORKING PRESSURES FOR CYLINDRICAL TANKS WITH DISHED HEADS AND PROPERLY INSTALLED WELDED JOINTS. TENSILE STRENGTH OF 55,000

Diam. (in.)	Plate thickness, (in.)										
	¼	5/16	⅜	7/16	½	9/16	⅝	11/16	¾	⅞	1
24	286	358	429	500	572	....	....	....	....	....	....
36	191	238	286	334	381	429	477	525	....	....	....
48	143	179	214	250	286	322	358	394	429	500	....
60	115	143	172	200	229	258	286	315	344	401	458
72	95	119	143	167	191	215	238	262	286	334	382
84	82	102	123	143	163	184	204	224	245	286	327
96	72	89	107	125	143	161	179	197	214	250	286
108	64	79	95	111	127	143	159	175	191	222	254
120	57	71	86	100	114	129	143	157	172	200	229
132	52	65	78	91	104	117	130	143	156	182	208
144	48	60	72	83	95	107	119	131	143	167	191

No. 8 in a series by W. L. Nelson, professor of petroleum refinery engineering, University of Tulsa

Ordering Your Right Valve today calls for a lot of "Know-How"...

THE PROBLEM

1

With valve materials on the "critical" list, your valve should contain the minimum of material essential to its purpose. In other words, exactly the correct size and type should be selected.

2

Mistakes in specifying valves can prove costly both to you and the war effort. And servicing or replacements to cover such mistakes become more and more difficult.

3

The war "turnover" in Purchasing, Engineering, and Maintenance personnel may have taken some of your valve experts.

A SOLUTION

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To make sure, our Engineering Department will gladly check your valve specifications, if you will indicate carefully the proposed application.

2

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PIPE LINES

Tennessee Pipe Laying Approaches Final Stages

Up to August 31 in the construction of Tennessee Gas & Transmission Co.'s system from Corpus Christi, Tex., to Cornwell, W. Va., a total of 1,056 miles had been welded and 1,019 miles backfilled. There remained 247 miles to be laid and backfilled. To complete the pipe laying for this 1,266-mile system, progress at an average rate of 8 miles daily would be required. However, it is reported that numerous sections have been finished and a number of spreads are so near completion as to be fairly certain of being finished before October 1 in accordance with a schedule for the pipe-laying job set up several months ago.

New Lines for Moving Elk Hills, Calif., Oil

WASHINGTON.—Three new pipeline outlets from the Naval Petroleum Reserve at Elk Hills, Calif., to accommodate the additional crude which the Navy is preparing to produce there have just been approved by the Petroleum Administration for War.

The Navy plans to step up production from Elk Hills to 65,000 bbl. per day, but 15,000 bbl. of this will be owned by Standard Oil Co. of California which has adequate facilities. The new lines will handle the 50,000 bbl. daily which the Navy expects to obtain as its share of the production.

Union Oil Co. of California will lay 9 miles of 8-in. pipe from Taft, Calif., to connect with its existing line to Port San Luis, to move 25,000 bbl. daily. Estimated cost of the project is $155,000.

The Texas Co. will lay 61 miles of 10-in. pipe from the Buena Vista tank farm of Standard Oil Co. of California to connect with the Valley Pipe Line in Kings County, to move 20,000 bbl. daily. Cost of this project is estimated at $1,459,237.

General Petroleum Corp. will lay 15,000 ft. of 6-in. pipe from the Buena Vista tank farm to connect with its system running to Torrance, Calif., and also 88,700 ft. of 6-in. loops along its line between Lebec and Torrance, to handle 5,000 bbl. daily. Estimated cost of this project is $287,225.

Ohio to Commence Work on Robinson-Indianapolis Line

Construction of Ohio Oil Co.'s 115-mile 8-in. refined-products pipe line from Robinson, Ill., to Indianapolis, Ind., is scheduled to start this month with the expectation of completing in October or November. The general contractor is Sheehan Pipe Line Construction Co. Welding is to be done by H. C. Price Co.

Manufacturers Laying 30-Mile Gas Line

For the laying of 30 miles of 16-in. natural-gas pipe line for Manufacturers Light & Heat Co., Williams Brothers Corp. is establishing an office at Claysville, Pa., where work is directed by Thelma Davis, spread superintendent. This line represents an unfinished section included in a program undertaken in recent years.

British American Lays Lines Near Calgary

British American Oil Co., Ltd., program calls for laying 17½ miles of pipe line near Calgary, Alta., of diameters including 6, 8 and 12-in. The work has been contracted by H. L. Gentry Engineering Co. which will handle the project as general contractor. H. C. Price Co. has contracted the welding.

Recent Completion of Pipe-Line Projects

Work carried on through the summer has recently been completed on several projects.

Yale Oil Pipelines, Inc., has finished and tested 80 miles of 6-in. and 8-in. for a crude-oil system connecting fields at Elk Basin and Frannie, Wyo., with refineries at Billings and Laurel, Mont.

During the past month, The Texas Pipe Line Co. has been pumping products at the rate of approximately 20,000 bbl. daily at 1,000 lb. pres-

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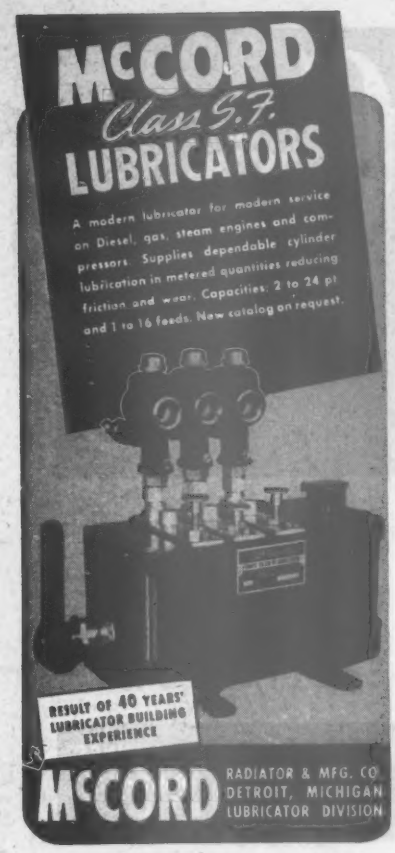
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sure through its new 34-mile 6-in. products line from Lockport, Ill., to Sinclair Refining Co. tankage at East Chicago and The Texas Co.'s East Chicago terminal.

Crude oil is moving through the Pan American Pipe Line Co.'s 36-mile 8-in. line from Willamar to Port Isabel, Tex.

Southern Detroit Revamps Natural-Gas System

Southern Detroit Gas Co. is undertaking the removal and relaying of 10 miles of 6-in. pipe line in an area 10 miles south of Monroe, Mich. The general contractor is Industrial Engineering Co. The welding contractor is H. C. Price Co.

Postwar Tanker Problems Analyzed

An American oil tanker fleet, largely war built, is destined to have great postwar influence.

Tanker production already has gone far beyond making good the heavy mortality among tankers in the war at sea, particularly off the eastern seaboard in 1942.

President J. Lewis Luckenbach of the American Bureau of Shipping estimates that by the end of 1944 the emergency shipbuilding program will bring the nation's oil-carrying tonnage "close to equaling in capacity the entire world tanker fleet existing before the war."

Five major prewar operating nations—Britain, the United States, Norway, Holland and Panama—controlled about 77 per cent of the world's oil carriers.

In the postwar period Norway and other similarly situated United Nations either will have to dip into an American surplus or seek a share of Axis-held tonnage to compensate for war losses.

The American Merchant Marine Institute estimates postwar American tanker holdings at 1,070 ships of 15,000,000 tons, excluding war losses and transfers, in contrast to global tanker tonnage in 1939 of about 17,000,000 tons.

Significantly, the institute reports that nearly half of required world prewar tanker use was for Western Hemisphere operations.

Many oil men regard competition from overland pipe lines as an unknown factor in the postwar use of tankers, which in prewar days carried 95 per cent of the oil supply to eastern seaboard states from the Southwest and from South American fields.

Shortly before Pearl Harbor, more than half of the nation's tankers were engaged in coastal trade.

"It is clear that we shall not need all the pipe lines and all the new tankers for supplying the East Coast market," says Charles H. Kunze, general manager for Socony-Vacuum Oil Co., Inc.'s marine department. Kunze says the excess new tankers "should not be laid up and allowed to rust" and that the surplus "should be offered for sale or charter to our Allies, even if the purchase price has to be adjusted to the lower foreign construction costs."

B. B. Howard, Standard Oil Co. (New Jersey) general manager for marine operations, urges government determination of the size of the postwar tanker fleet "with first consideration being given to our national and economic security requirements, the surplus tonnage to be disposed of to foreign interests or scrapped."

Sinclair Removes Old Gathering Lines

Sinclair Pipe Line Co. has contracted with H. C. Price Co. for taking up and rough-cleaning 8 miles of 3-in. screw pipe. The work is fairly evenly divided between areas near Tulsa and Nowata, Okla. The pipe is to be hauled to Bartlesville, Okla., for racking.

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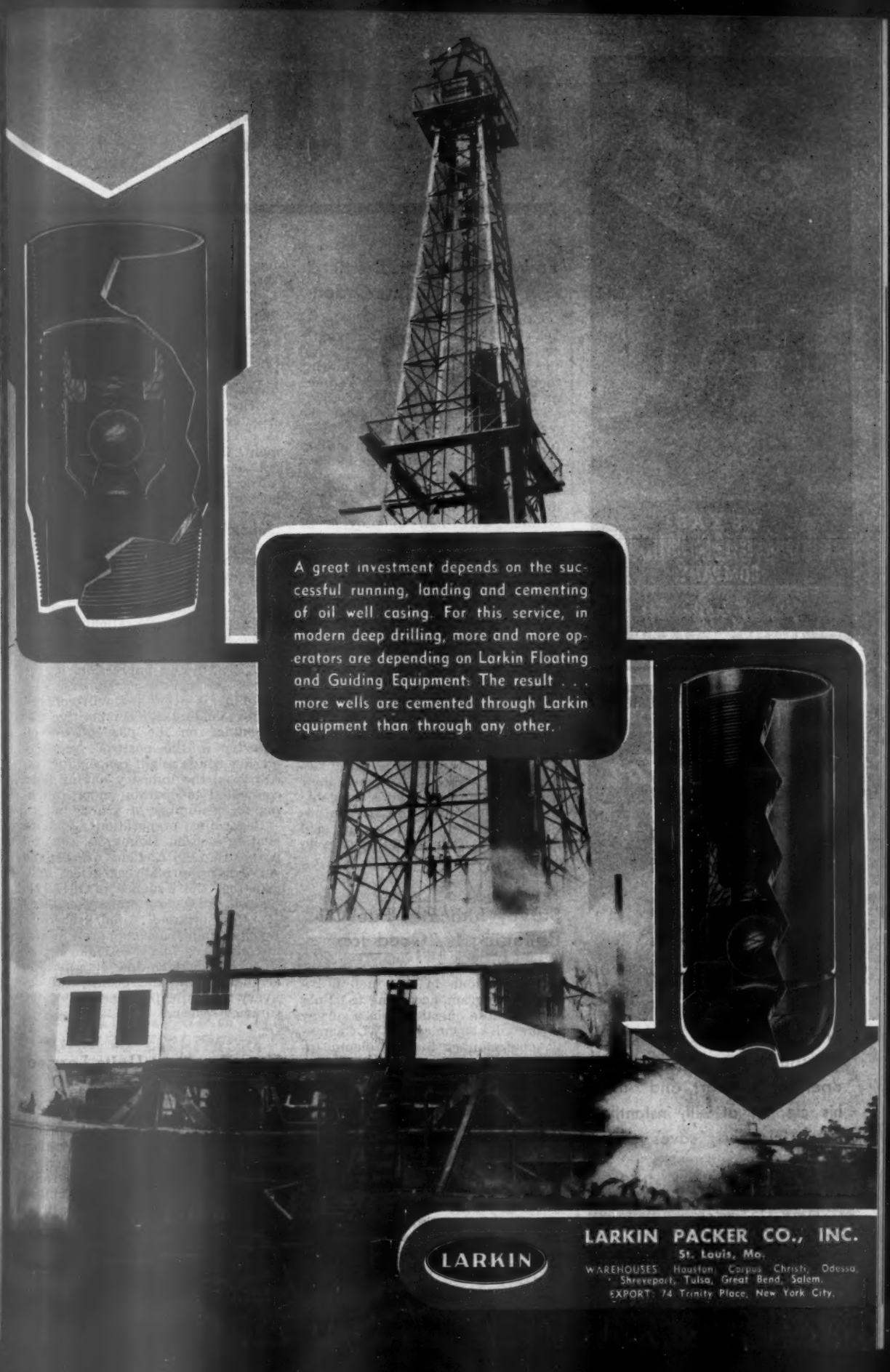
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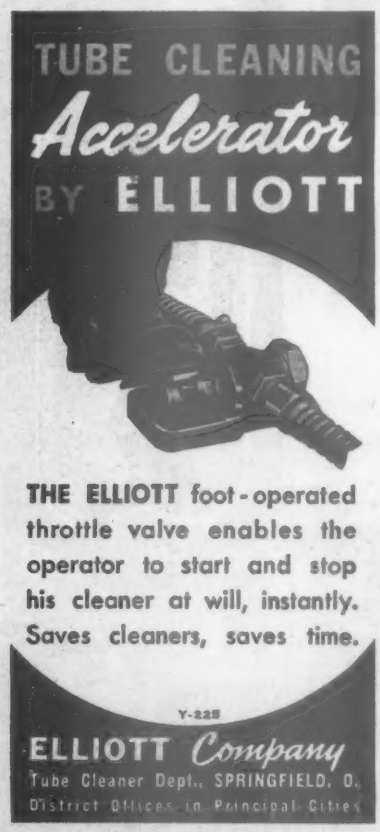
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REFINING

Fewer Refiners in District 2 Get Crude-Sharing Order

CHICAGO.—Fourteen refiners in District 2 (Middle West) have received from Petroleum Administration for War a directive requiring them to share with 16 other refiners in the district 21,795 bbl. of crude oil daily in September, under the wartime allocation regulation. This represents a substantial drop in both quantity of crude and the number of supplying and receiving companies, compared with the figures for the preceding month. In August, 21 refiners were told to provide 21 other refiners with 28,620 bbl. daily. The volume of crude involved for September is the smallest since the sharing program was put into effect.

Figures for recent months preceding August follow: 24,175 bbl. daily and 17 suppliers in July; 27,350 and 16 in June; 27,535 and 16 in May; 29,350 and 20 in April; 46,600 and 21 in March; 47,590 and 20 in February; 64,690 and 28 in January.

PAW's District 2 headquarters also sent a telegram to those refiners in the district who received authority last May to increase their operations if crude were available and their operating and storage position permitted. This telegram said the authorization would remain in effect for September.

Survey Indicates Fuel-Oil Rationing Is "Good Job"

WASHINGTON. — A "good job" has been done in the fuel-oil rationing program, according to 82 per cent of those questioned in a survey of fuel-oil consumers. J. W. Connolly, chairman of the Petroleum Industry War Council subcommittee on fuel-oil conservation, who announced the result of the survey, says in a communication sent to distributors:

"This is a remarkable record and you are to be congratulated for it would not have been possible without your wholehearted support. There is a tendency to doubt the necessity for continued fuel oil rationing. The reason is the widespread belief that the war in Europe will soon be won, that the need for rationing will cease and that there will be plenty of oil.

"This kind of thinking is dangerous. Even though the war in Europe ends tomorrow, we still have a vast naval, air and amphibious war to fight in the Pacific. With the thousands of miles of sea lanes, vast quantities of oil will be needed.

"The truth is that in the opinion of your industry's leaders, your military command and your government, the oil supply situation may get very tight this season."

The oil industry itself has an important stake in the smooth and effective operation of the fuel-oil rationing program for the approaching heating season as a matter of good-customer relationship, Myron R. Holmgren, chief of the fuel-oil rationing division of Office of Price Administration, says in the current issue of the fuel-oil rationing letter.

The industry's concern, Holmgren says, arises from the fact that it will "leave a better impression in the minds of fuel-oil consumers after rationing is over, and will contribute to avoiding any competitive disadvantage on the part of the oil industry in the postwar free fuel market which might conceivably result from the industry having been compelled to operate under rationing for a number of years."

Regarding preparations for the heating season, Holmgren says reports from OPA field offices and surveys by private agencies, indicate that the issuance of 1944-1945 fuel oil rations is running far ahead of the original time schedule. Enough coupons are apparently now in consumers' hands to make it possible for dealers and suppliers to arrange a full and economical delivery schedule for the rest of the summer season.

Two Towboat Units Leased To Private Carriers

WASHINGTON. — Two towboat-barge units, built under sponsorship of Office of Defense Transportation, have been leased to private carriers, namely, Citizens Oil Co., of Tallahassee, Fla., and Cornelius Kroll & Co., of Houston. This makes a total of 21 such units, each consisting of a towboat and four wooden barges, now in service on the intercoastal canal moving residual oil from

Texas refineries to the western coast of Florida.

Ceilings for Distributors of Oil Products Cut by OPA

WASHINGTON. — Reduction in ceiling prices at all levels of distribution for gasoline, kerosene, distillate fuel oils and residual fuel oils in certain parts of the Atlantic seaboard area are announced by Office of Price Administration. Lower costs for wartime methods of delivery from producing areas have made possible the ceiling-price cuts, which become effective September 10 at service stations and other retail establishments, and September 1 for all other sellers. The later effective date for retailers will allow for the sale of inventories purchased before September 1.

North Carolina, South Carolina, Georgia, that part of Florida east of the Apalachicola River, most of West Virginia, and western sections of Pennsylvania and New York are the areas covered by OPA's action.

The reductions, which are the same for all levels of distribution, range from 0.3 to 0.6 of a cent per gallon on gasoline, kerosene and distillate fuel oils throughout these areas, and are 15 cents per barrel on residual fuel oils in the affected sections of West Virginia, Pennsylvania and New York. Varied ceiling prices prevail in the areas affected, depending on location, classes of purchasers and other factors, but all ceilings are reduced by the same amounts.

Gulf Coast Gasoline Stocks Continue Upward Trend

HOUSTON. — Gasoline stocks at plants of Gulf Coast Refiners Association continued their upward trend during the first half of August, standing at 1,230,112 bbl., an increase of 11,197 bbl. over the total reported for July 31. Stocks held by the same 11 active members of the association on August 15, 1943, were 1,646,931 bbl. and on the corresponding date 2 years ago were 2,665,000 bbl.

Automotive gasoline stocks considered alone were 413,493 bbl. on August 15, a decrease since July 31 of 112,733 bbl. This total represents about 64 per cent of the 648,384 bbl. of automotive gasoline in storage at the corresponding period last year, but it is only 25 per cent of the 1,810,000 bbl. on hand July 31, 1942, when such a volume was considered about normal.

Operations continued at a high level, with crude-oil throughput at the 11 active plants averaging 123,253 bbl. daily, compared with 121,522 bbl. during the second half of July. Crude runs were at 88 per cent of present operating capacity of 140,000 bbl., which represents an increase of 35,958 bbl. daily when compared to operations at 72 per cent of capacity a year ago when the GCRA group processed 87,295 bbl. a day during the first half of August. During the same period in 1942 crude runs were at the rate of 94,000 bbl. a day.

Kerosene stocks of 185,882 bbl. on August 15 indicate 15,094 bbl. increase during the 2 weeks. Diesel gas-oil stocks were 129,292 bbl., an increase of 28,632. Stocks of other grades of gas oil decreased 66,304 bbl. from 829,577 bbl. August 1 to 763,273 August 15.

No. 5 fuel oil at 249,388 bbl. was an increase of 3,276 bbl. Bunker C fuel-oil stocks were at 327,990 bbl., a decrease of 82,826. Cut-back asphalt stocks were reported at 23,957 bbl.

Total stocks of all products in the refineries of the association group were reported at 3,104,791 bbl. August 15, a decrease of 95,656 bbl. during the first half of the month.

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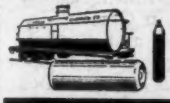

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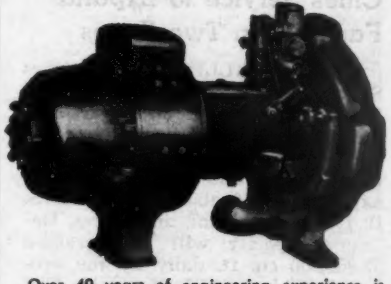

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Natural Gas

Oklahoma Natural Acquires Production and Lines

Oklahoma Natural Gas Co., Tulsa, has entered into an agreement to buy gas production, pipe lines and commercial distribution systems of Oklahoma Utilities Co. in and around Bristow and Mounds, Okla., according to an announcement of Joseph Bowes, president of Oklahoma Natural.

Actual transfer probably will not be completed until December, Bowes said, as Oklahoma Utilities must obtain governmental authorization to make the sale. Included in the transaction are properties in Creek, Lincoln, Tulsa, Okfuskee and Okmulgee counties. Gas production approximately balances the sales through the distribution system, so there will be no additional drain upon Oklahoma Natural's present supplies. Consideration involved is expected to be about $280,000. Oklahoma Utilities headquarters are in Fort Worth.

Cities Service to Expand Facilities in Two States

BARTLESVILLE, Okla. — Cities Service Gas Co. has asked Federal Power Commission and War Production Board to authorize improvements and extensions of its system in Oklahoma and Kansas involving expenditure of about $1,500,000, S. B. Irelan, president, announces. Delivery capacity will be increased 32,000,000 cu. ft. daily by the proposed extensions, Irelan said. The work, if started at once, could be finished by the end of the year. The contemplated expansion includes:

Construction of 52 miles of 16-in. pipe line from Shidler, Okla., to Caney, Kans., to carry gas from the Hugoton field.

Construction of 6½ miles of 16-in. line from Wilson County, Kansas, connecting the two existing transmission lines.

Improvements and expansion of the company's Graham compressor station near Independence, Kans., and at the Petrolia station in Allen County, Kansas.

"This additional gas will furnish ample supplies to meet all domestic demands on the company's east-side system this winter," Irelan said. "It also will reduce curtailment of industrial gas to a minimum and will enable the company better to utilize its large underground storage facilities in the former gas fields near Welda and Craig, Kans., with capacities of 27,000,000,000 cu. ft.

United Gas Corp. Hearing Postponed to October 4

WASHINGTON. — Federal Power Commission has postponed to October 4 the hearing previously set for September 1 on an application by United Gas Corp. for a renewal of authorization to export natural gas from Texas to the Republic of Mexico. The gas, according to the application, is for distribution in the city of Nuevo Laredo, Tamaulipas, Mexico, and environs. Postponement of the hearing was granted on the company's request.

The applicant proposes to replace with a 6-in. pipe line a portion of its 4-in. line extending from Laredo, Tex., to the international boundary. It says the new facilities are necessary for delivery of increased quantities of gas to customers of Compania de Gas de Nuevo Laredo, S. A., in Mexico.

United Gas Corp., the order adds, has executed a new sales contract with Compania de Gas de Nuevo Laredo, S. A., to supersede its present contract. FPC in 1940 authorized the applicant's exportation of natural gas from the United States to Nuevo Laredo, Mexico, in accordance with the terms of the present contract. This authorization terminates automatically upon expiration of the contract, but is subject to renewal if the commission finds it is not inconsistent with the public interest.

Southern Natural Gas Co. Says Law Is Confusing

WASHINGTON. — Appearing before Federal Power Commission, C. P. Rather, president and director of Southern Natural Gas Co., Birmingham, Ala., said his company was confused as to the intent and meaning of the natural gas act amendment of February 7, 1942, which requires that no natural gas company undertake construction or operation of facilities without a certificate from the commission.

Southern Natural, Rather said, failed to seek earlier authorization for construction and operation of facilities estimated at $684,000 because the additions chiefly involved operating necessity and not an extension of the system.

Rather held that construction of all facilities commenced by his company after February 7, 1942, was in the public interest, and the company sought authority to construct and operate the facilities at an estimated cost of $514,392 in Perry, Dallas and Jefferson counties, Alabama; Issaquena County, Mississippi, and Fulton and Bibb counties, Georgia.

Authority to construct additional facilities including lines, dwelling houses, meters and air-cooled mufflers at an approximate cost of $273,800 was requested.

Rather also asked authority to construct at an approximate cost of $147,272 and operate 5 miles of pipe line near Spaulding, Jefferson County, Alabama; to install seven air-cooled mufflers at the company's Perryville, La., compressor station; to install two gas scrubbers at the Logansport, La., dehydration plant; to construct a dehydration plant in Monroe gas field near the Perryville station; to install a new water-cooling system at Perryville; and to install miscellaneous items including meters, lines, and radio equipment.

A.G.A. Decides to Hold Its Annual Meeting October 5

NEW YORK.—The executive board of American Gas Association has decided by a mail vote to hold the annual meeting of the association in the Engineering Societies Building, New York, October 5. The members will elect officers, receive reports and transact routine business. It is expected that the meeting, opening at 10 a.m., will be over by noon.

OWU Restrictions on Plant Improvements Modified

WASHINGTON. — Natural-gas utilities may make certain minor plant additions and improvements up to $10,000 in material cost, without obtaining approval from Office of War Utilities, War Production Board, OWU announced last week. The former limit was $1,500.

It is expected that approximately 1,200 application forms coming to Washington each month will be eliminated. Furthermore, about 5,000 monthly purchase clearances through regional inventory control officers will be eliminated.

Exploration and Drilling

Week's Highlights

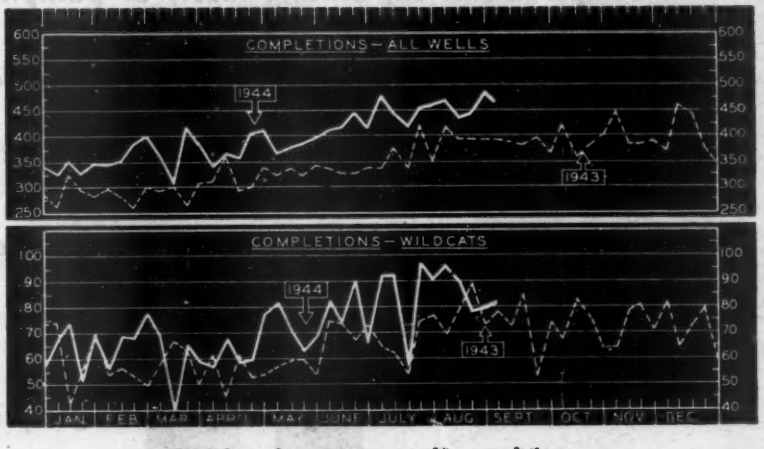
GEOPHYSICS has paid off again in Carter Oil Co.'s search for deep Wilcox oil along the eastern rim of the Anadarko Basin off the west flank of the Nemaha ridge in Oklahoma.

Carter 1 N. R. Johnson, SW SE 30-8n-2w, in McClain County, about 20 miles south of Oklahoma City, gives every indication of being a good producer and opening a new Wilcox sand pool. The test was cored from 8,205-14 ft., and recovered 8 ft. 3 in. of sandy dolomite and dolomitic sand, fairly tight, with some porosity, spotty staining and odor. A drill-stem test was made with packer set at 8,196 ft., no choke on top, ¼-in. choke on bottom. On a 37-minute test, it blew air at once, gas in 3 minutes, sprayed oil in 5 minutes. The well was then flowed into pits and made an estimated 15 bbl. of oil per hour and 2,000,000 to 3,000,000 cu. ft. of gas.

The drill pipe was pulled and showed 540 ft. of clean oil with no water. Drill pipe was rerun and a second core is being taken from 8,215-25 ft.

One of the remarkable things about Carter's play along the west flank of the Nemaha ridge is that it has now drilled three wildcat tests in an area stretching only 7 miles east and west and 4 miles north and south. The score is now two successful pool openers out of three tries, both producing from the second Wilcox. The first two wildcats were drilled simultaneously, and when one of the two was successful, the present well was started immediately.

The plays are made for Wilcox in geophysical highs paralleling the ridge. The first to be completed was 1 Johnson ranch, SW NE 13-8n-4w, 7 miles west and 2½ miles north of the latest strike. The Johnson ranch test was dry in the second Wilcox at 10,462 ft., and was finally abandoned in April this year. The second test was 1 Cottingham, SE SW 4-7n-3w, 4 miles west and 1½ miles south of the newest pool opener. The Cottingham found the second Wilcox at 10,633 ft., and gave every indication of being a producer of substantial potential flow, but was pinched back to its 300-bbl. per day allowable.



Solid line charts current weekly completions

COMPLETIONS IN ALL FIELDS . . .

Week ended September 2, 1944

	Oil	Gas	Dry	Total	Footage	Total Comp. to date 1944	1943
N. Y., Penna., W. Va.*	53	28	5	86	167,399	2,232	2,214
Ohio	5	8	10	23	57,881	646	567
Indiana	2	0	2	4	11,380	153	147
Kentucky	16	1	4	21	39,195	470	256
Illinois	17	0	19	36	94,043	1,222	1,130
Michigan	3	1	10	14	31,588	420	369
Kansas	20	1	17	38	130,858	1,202	1,054
Nebraska, Missouri, Iowa	0	0	0	0	0	22	30
Oklahoma	18	7	16	41	146,882	1,142	759
Texas:							
North Central	19	0	8	27	86,386	984	901
West	25	2	5	32	162,223	1,011	546
Panhandle	7	1	0	8	24,443	160	119
Eastern	1	0	1	2	11,762	211	186
Gulf Coast	12	1	10	23	154,656	797	288
Southwest	4	0	9	13	47,365	482	580
Total Texas	68	4	33	105	486,835	3,645	2,620
Louisiana:							
Northern	4	1	2	7	26,532	204	206
Southern	9	1	3	13	121,330	325	240
Total Louisiana	13	2	5	20	147,862	529	446
Arkansas	1	0	3	4	17,539	150	161
Mississippi	4	0	0	4	20,140	90	58
Southeastern States	0	0	1	1	8,240	25	†
Montana	9	10	1	20	46,066	237	139
Wyoming	2	0	1	3	13,578	111	86
Colorado	1	0	0	1	6,281	22	18
New Mexico	8	0	3	11	29,477	262	144
California	31	1	7	39	118,453	1,316	856
Total United States	271	63	137	471	1,573,697	13,896	11,054
Total previous week	293	40	156	489			
Total Sept. 4, 1943	208	44	143	395			

*Does not include 48 pressure wells. †Included in total shown for Mississippi.

The utility of any equipment depends in a large measure on the "service available when and where it is in use". From a single field assembly bolt to a complete derrick, drilling mast, or pumping unit you can get just whatever you need from Lee C. Moore's conveniently located stores.

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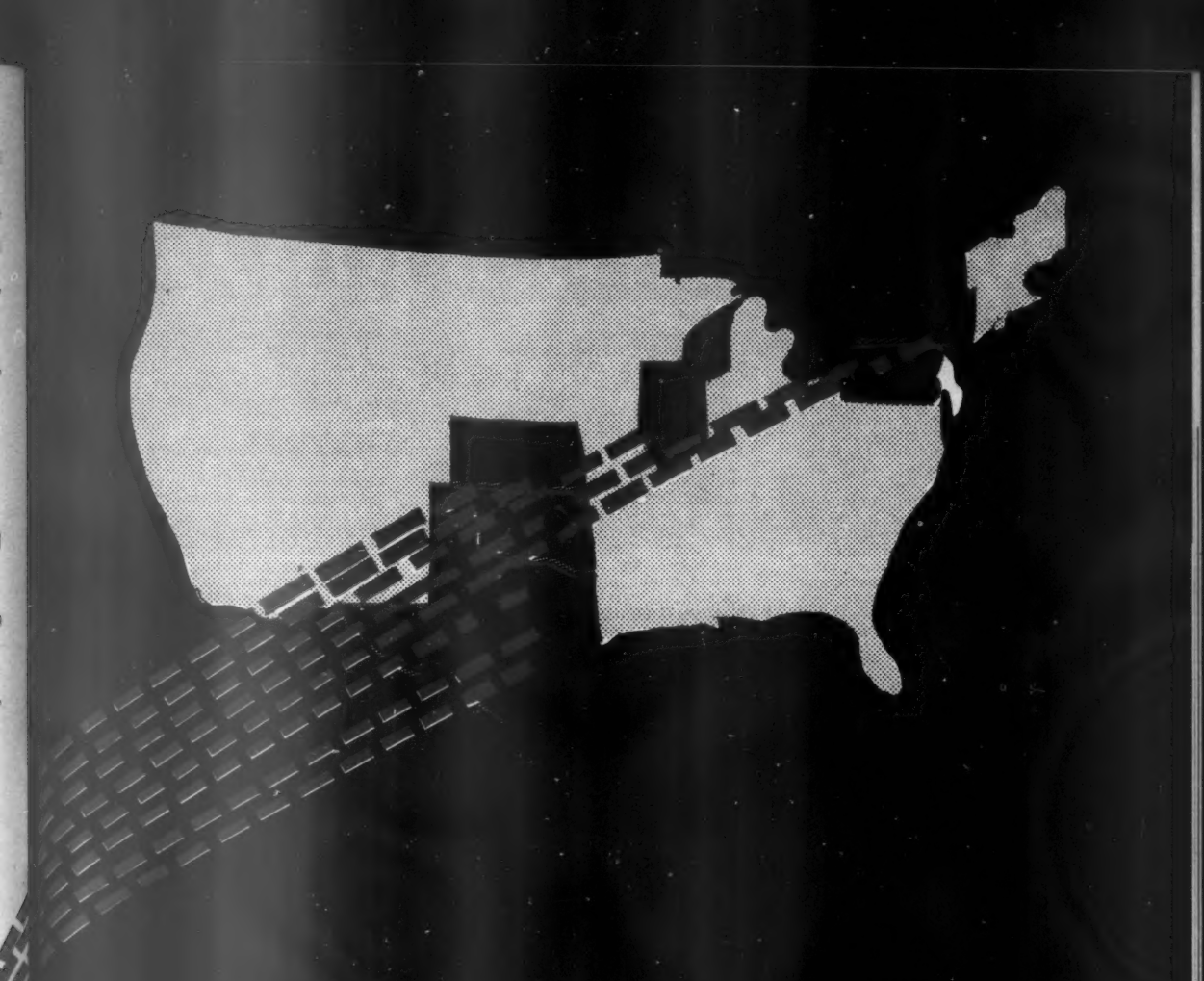

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OKLAHOMA

New Wilcox Strike in McClain County

McCLAIN County appears to have another Wilcox pool in the making, the second for this year, as Carter Oil Co. 1 N. R. Johnson, SW SE 30-8n-2w, on drill-stem test of Second Wilcox sand showed for an estimated 15 bbl. per hour of 36.7° gravity oil with 2,000,000 to 3,000,000 cu. ft. of gas. Test was made after coring from 8,205-14 ft., and a second core is now being taken at 8,215-25 ft. The latest strike is 4 miles east and 1½ miles north of the Washington pool, which was discovered last May by Carter.

West Edmond field pipe-line runs averaged 23,100 bbl. per day for the week from 123 wells, but completions and wells testing at the end of the week indicated total producers are at the 130 mark. The mid-week indicated 108 drilling wells and 83 locations, 33 of the latter having derricks up. Of the 108 drilling wells, 13 were then testing, and about 5 of these were probably in the completion stage by the end of the week.

In Garvin County, Sinclair Prairie 1 Allred, NE NW SE 20-3n-3e, a wildcat discovery, was deepened with cable tools from 1,909 ft. to 1,914 ft., swabbed 14 bbl. per hour for 4 hours, then was deepened again to 1,919 ft., and put on swab, with no report yet available on latest test. E. J. Kubat 1 Dixon, NE SW SE 9-3n-1e, which showed for a producer on drill-stem test, drilled to 3,567 ft., perforated at 3,423-29 ft., showed oil, gas and water. It is being squeezed and will reperforate for a test at higher levels.

OKLAHOMA WILDCAT COMPLETIONS

Canadian County: Fox & Fox 1 Koemer, SE SW 26-14n-5w, dry, TD 7,360 ft., Bois d'Arc 7,247 ft.

Cleveland County: Sinclair Prairie 1 Theimer, NE SE SW 20-10n-3w, dry, TD 9,287 ft., McLish 9,036 ft., sand 9,200 ft.

Garvin County: Dixon & Lausen 1 Freeman, SW SW NE NE 36-1n-1w, dry, TD 1,625 ft., broken lime 1,220 ft.

Lundy & Shear 1 Meeks, NW NW NW 32-1n-1w, dry, TD 2,504 ft., Pontotoc lime 1,187 ft.

Greer County: E. M. Thomason 1 Sappington, SE NE NW 10-6n-21w, dry, TD 338 ft., granite wash 323 ft.

Hughes County: Northern Ordnance 1 Green, NE SE NE 36-8n-11e, dry, TD 3,796 ft., upper Viola 3,580 ft., Cromwell 3,660 ft.

LeFlore County: LeFlore Gas & Electric 1-B Tompos, SW SW 31-9n-27e, 250,000 cu. ft. gas, TD 4,800 ft., pay zone 4,798-4,800 ft., sand 4,798 ft.

Lincoln County: Macmillan Producing 1 Healy, NW NW NE 14-15n-6e, dry, TD 3,300 ft., Inola 3,263 ft., Bartlesville 3,280 ft.

Herndon Drilling 1 Orr, SW NE 11-13n-2e, dry, TD 5,413 ft., Wilcox 5,332 ft., second Wilcox 5,405 ft.

Noble County: Stanolind 1 Compton, SW SW SE 1-24n-2w, dry, TD 4,974 ft., dolomite 4,931 ft., Wilcox 4,964 ft.

Okmulgee County: T. C. Greer 1 Beall, NE SE NW 23-11n-12e, dry, TD 1,212 ft.

Payne County: Frank Russell 1 Young, discovery, SW NW NE 9-19n-1w, flowed 24 bbl. per day from pay zone 4,865-77 ft., TD 5,065 ft., Woodford 4,788 ft., Misener 4,865 ft., Viola 4,877 ft., Wilcox 4,979 ft., second Wilcox 5,050 ft.

EASTERN TEXAS

Three Deep Tests in East Texas Indicate Producers

DALLAS. — Indications of production were registered during the past week by three deep tests in East Texas. Humble Oil & Refining Co. 1 Nichols, in southeastern Hopkins County, Isaac Friddle Survey, is reported to have found sufficient saturation in approximately 20 ft. of Bacon lime at 7,860-95 ft. to promise commercial oil production. Its last core, at 7,895-7,909 ft., recovered lime and shale with no porosity, and it was drilling ahead through the Rodessa section. With elevation of 472 ft., it topped Massive anhydrite at 7,740 ft., based the Massive at 7,860 ft. The Bacon lime is one of the producing horizons in the New Hope field in Franklin County.

Cherokee County.—W. H. Foster et al 1 Bowling, southeast of Lone Star, logged base of Massive anhydrite at 7,185-7,200 ft., made a 32-minute drill-stem test of the section at 7,353-76 ft., recovered 150 ft. of oil and gas-cut mud and showed a steady gas blow with no salt water. It drilled ahead to 7,717 ft. and planned to resume coring at that point.

Van Zandt County.—Northern Ordnance Co. 1 Shelton, in the L. Smith Survey, 4 mile southeast of Martin's Mill, was attempting a drill-stem test at 8,266-87 ft. after samples indicated possible gas and distillate production. It is in the Rodessa section, with electrical log showing base of Massive anhydrite at 8,252 ft., top at 8,080 ft., top of Paluxy 6,665 ft.

Limestone County. — Zephyr Oil Co. 1 Jim Sharp, 4 miles northwest of Groesbeck, topped the Pettit lime at 5,326 ft., drilled to total depth 5,387 ft., ran electric log and was setting casing to about 5,250 ft. preparatory to testing.

Red River County. — Two tests were marked off as dry holes last week. The Texas Co. 1 Solomon, Smackover-lime failure, was plugged at total depth 6,151 ft. in Paleozoic rocks, and Oscar Donnelly et al 1 Ross Mitchell was plugged after bailing salt water with a slight show of oil from perforations in casing at 1,843-50 ft.

KANSAS

Feltes Pool in Barton County Gets Good Well

BLACK-MARSHALL OIL CO. 3 N. Weber "A," N½ NE SE 11-16s-12w, Feltes pool in Barton County, completed in the Arbuckle at 3,322 ft., drew a potential of 3,000 bbl., for the best completion of a quiet week for Kansas operators.

Completions dropped off after last week's heavy schedule, 20 oil wells, 1 gas well and 17 dry holes making up the total of 38, compared to 53 completions last week. Included in this week's total was the formal completion of Carter Oil Herrington lime gas discovery in Finney County, south of the Nunn pool, with final results indicated at 971,000 cu. ft. Also included was Aylward Production Co. 2 Johnson "B," a 20-bbl. Topeka lime discovery a few miles west of the Zurich pool in Rooks County.

New operations reported also dropped off, totaling 29 including 6 wildcats compared to 45 for last week, which included 11 wildcats. Of the 6 new wildcats, Barton County had 1, Butler 2, Ellis 2 and Rooks 1.

KANSAS WILDCAT COMPLETIONS

Dickinson County: Herrington & Larieux 1 Bevin, NW NW SW 14-16s-4e, dry, TD 2,310 ft., Mississippi 2,260 ft.

Edwards County: W. N. Dandenburg et al 1 Perrett, N½ NW NE 29-26s-16w, dry, TD 4,896 ft., Arbuckle 4,846 ft.

Finney County: Carter 1 Miller, NE NE SW 26-22s-34w, 971,200 cu. ft. gas from pay zone 2,608-33, TD 2,833 ft., Herington 2,601 ft., Krider 2,663 ft., Winfield 2,719 ft., Fort Riley 2,802 ft.

Osborne County: Iron Drilling et al 1 Hirst, N½ SE SE 10-10s-12w, dry, TD 3,011 ft., Kansas City 2,910 ft.

Pratt County: Barnsdall 1 Barnes, NE NE NE 18-28s-13w, dry, TD 4,625 ft., Arbuckle 4,568 ft.

Reno County: Texas 1 Miller, NW NW SE 12-24s-10w, dry, TD 4,170 ft., Arbuckle 4,152 ft., Simpson 4,084 ft.

Rooks County: Aylward Production 2 Johnson "B," NW SE NE 35-10s-19w, discovery, 20 bbl. per day from pay

DAILY AVERAGE PRODUCTION FOR WEEK

	Sept. 2 crude oil	Distillate, allied products	September PAW quota all oils	Aug. 26 crude oil
Arkansas	80,350	4,500	82,900	80,900
California	864,750	51,100	936,700	865,450
Colorado	8,600	.....	8,000	8,500
Eastern	69,500	6,100	81,000	70,200
Illinois	200,650	11,500	222,000	205,300
Indiana	13,250	.....	14,000	13,050
Kansas	266,250	4,300	279,700	278,900
Kentucky	25,200	2,500	27,700	24,250
Louisiana	362,900	35,000	385,000	362,500
North Louisiana	73,800	.....	.....	73,500
South Louisiana	289,100	.....	.....	289,000
Michigan	50,200	400	51,500	50,600
Mississippi	46,400	.....	45,000	48,750
Montana	20,200	200	24,300	20,800
Nebraska	900	.....	1,000	500
New Mexico	106,050	5,500	115,500	106,100
Oklahoma	338,200	27,000	370,800	342,000
Texas	2,108,450	138,000	2,303,000	2,108,450
East Texas	371,850	.....	.....	371,900
East Central Texas	147,550	.....	.....	147,500
North Central Texas	148,400	.....	.....	148,500
Texas Panhandle	98,750	.....	.....	98,800
West Texas	485,100	.....	.....	485,000
South Central (S.A.)	19,250	.....	.....	19,250
South Texas (Laredo)	77,500	.....	.....	77,400
Lower Gulf Coast	224,800	.....	.....	224,900
Upper Gulf Coast	535,250	.....	.....	535,200
Wyoming	86,950	3,000	103,200	86,800
Total United States	4,648,800	289,100	5,051,300	4,673,050
Total production January 1-September 2, 1944				1,105,995,550 bbl.
Same period last year				975,900,200 bbl.
Change from previous week, down				24,250 bbl.

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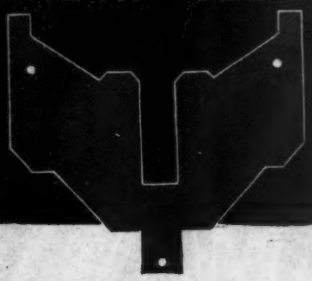
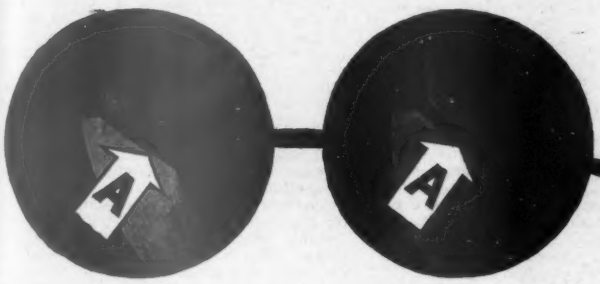
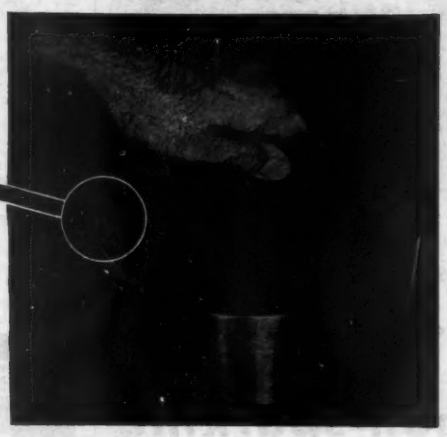


CHECKING THE VALVE SEAT FOR BUSHING WEAR





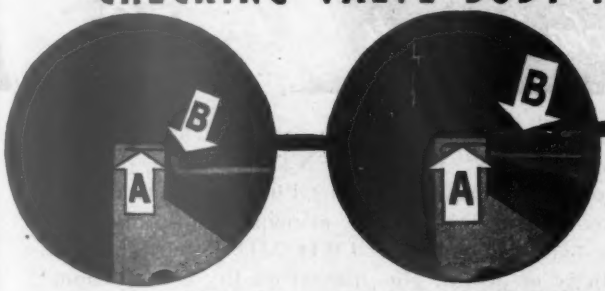
TIME TO CHANGE BUSHING

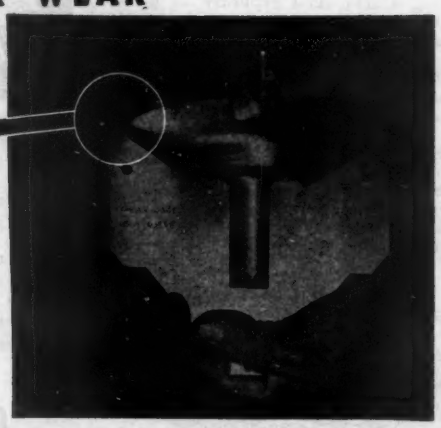
When the bushing is worn and needs changing, the wear gage touches the sealing surface of the valve seat as shown at (A).

NEW BUSHING INSTALLED

Notice how the wear gage stands away from the sealing surface of the valve seat when the bushing is in good condition. This means long, trouble-free service ahead.

CHECKING VALVE BODY FOR WEAR





GAGING A WORN BODY

When the body is worn and needs changing, the line on the wear gage (A) is above the surface of the valve body (B) as shown.

HOW GAGE APPEARS ON A NEW BODY

Notice how the line (A) is well below the surface of the body (B). Prompt changing of worn valve bodies results in long insert life and greatest freedom from valve troubles.

WRITE US FOR THIS "FREE" wear gage . . . or request it through your supply store . . . Use it to double the life of your Mission valves by changing the wear-taking bushing at the proper times.

Mission MANUFACTURING CO.
HUMBLE ROAD HOUSTON, TEXAS

4A-15

zone 3,070-80 ft., TD 3,625 ft., Topeka 3,070 ft.

Saline County Dale L. Morris 1 Bitter, S½ SW NE 11-15s-2w, dry, TD 2,789 ft., Mississippi 2,749 ft.

Stafford County: Vickers 1 Radke, NE SW SW 30-23s-13w, dry, TD 4,072 ft., Arbuckle 4,032 ft.

APPALACHIAN FIELD

Texas Rigging Up for Deep Test in Washington County

PITTSBURGH. — Following field work and seismograph study, the initial deep test of The Texas Co. in Pennsylvania has started in Cross Creek Township, Washington County, where a rig is being built on the J. E. McCullough farm. This cable-tool test, scheduled for the Clinton sand, is on the Burgettstown Quad, about 9,000 ft. southeast of the town of Cross Creek. To the southwest, in Ohio, Texas is drilling a test to the Clinton sand on the E. A. Mizer farm in Stock Township, Harrison County, which has reached 2,382 ft.

In Kiskiminetas Township, Armstrong County, C. W. Beecher completed a gas well on the W. T. Balsiger farm, gaging 1,200,000 cu. ft. with the Hundred-foot sand at 1,475 ft.; gas, 1,541 ft.; total depth 1,547 ft.

In Boone County, West Virginia, South Penn Natural Gas Co. completed a semi-wildcat on the J. A. Wetherell tract of 1,271 acres in Washington district as a Big lime gas well gaging 8,000,000 cu. ft. a day before being shot or acidized. The top of the Big lime was logged at 1,176 ft. with a total depth of 1,250 ft.

In Preston County, the test of William E. Snee et al on the Harry Sisler farm on Briery anticline, Portland district, logged the Tully lime at 4,765-90 ft. with a starting elevation of 2,186 ft. It appears to be running high on structure. It is drilling at 4,938 ft.

CALIFORNIA

Standard Opens Gas Field In Alpaugh District

LOS ANGELES.—Standard Oil Co. of California discovered a new gas field last week but productive acreage appeared limited. Standard's 1 Von Glahn in 34-23s-22e to the southeast was higher structurally than the current completion in 29-23s-22e, but failed to find any indication of oil or gas. The discovery is 1 Cutter Unit, in the Alpaugh district of Kings County, approximately 10 miles northwest of the Delano-Trico gas field. It showed up favorably on a formation test although some salt water was recovered in the tester.

On final completion 1 Cutter Unit flowed at a daily rate of 7,500,000 cu. ft. of gas from the so-called C zone, along with 85 bbl. of water ranging from fresh to salty. Total depth is 3,630 ft., with an effective depth of 3,555 ft. It appears probable the Alpaugh test is an edge well, both because of the salt water found and the fact the well is producing from a zone only 10 ft. thick. A lower zone showed salt water, precluding commercial production.

Superior Oil Co. surprised observers by abandoning 68-30 Brackney in the San Joaquin district of Fresno County, although this wildcat recovered 1,000 ft. of clean 27-gravity oil on a formation test at 6,993-7,010 ft. The company ap-

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parently concluded the relatively thin sand in the Kreyenhagen did not justify a production test. It is expected Superior will drill another test.

At Elk Hills Standard of California is running 14 strings of tools and has announced 8 additional locations. All drilling at Elk Hills is let out to drilling contractors, but Standard is in charge of this work on a nonprofit basis. At Coles Levee, Standard's deep test is rotating ahead at 14,842 ft., within 162 ft. of the existing California deep drilling record of 15,004 ft. established several years ago by Continental Oil Co. in the discovery well at Wasco in Kern County. This is the deepest hole drilled by Standard with its own crews.

Standard's deep test in the Greeley field, Kern County, in 18-29s-26e, has finished a fishing job at 13,469 ft. and the hole is being reamed below the shoe of a 7-in. string of casing cemented at 11,997 ft. This well has found some Eocene sand near bottom of the hole and an early test is expected.

Standard of California will start work within the next week or so on a deep test on the Cahn lease in the Lost Hills field of Kern County, in conjunction with General Petroleum Corp., Richfield Oil Corp., Universal Consolidated Oil Co. and Union Oil Co. This field was discovered in 1907, but only one deep well has been drilled and it encountered a high head water.

CALIFORNIA WILDCAT COMPLETIONS

Alpaugh wildcat district, Kings County: Standard of California 1 Cutter Unit, 29-23s-22e, 7,500,000 cu. ft. gas, no oil, perf. 3,425-35 ft., TD 3,630 ft., PB 3,555 ft.

Arvin outpost well, Kern County: Continental 1 Derby, 35-31s-29e, dry at 8,899 ft.

Kern Front outpost well, Kern County: E. B. Hall & Co. 1 Hunt, 28-27s-27e, dry at 1,970 ft.

Mount Poso outpost well, Kern County: Barnsdall 1 Fitzhugh, 32-27s-28e, dry at 2,179 ft.

Princeton wildcat district, Colusa County: Standard of California 1 Princeton Comm., 24-18n-2w, dry at 5,198 ft.

San Joaquin wildcat district, Fresno County: Superior 68-30 Brackney, 30-15s-17e, dry at 8,045 ft.

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SOUTH LOUISIANA

Union Sulphur's Deep Test Has Showing of Oil

NEW ORLEANS.—Union Sulphur Co. 2 J. P. Gueno, in Branch field, Acadia Parish, had sand showing oil at 11,044-104 ft., set 5½-in. liner at 10,478-11,125 ft., with total depth of 11,316 ft. In going in to perforate the gun went off accidentally at 9,616 ft. and these holes had to be squeezed off. The well is now waiting on cement to set before going in again to perforate the 11,000-ft. sand.

Pure Oil Co. 1 General American Transportation Corp., discovery well of the Good Hope field in St. Charles Parish, flowed a daily potential of 340.06 bbl. on 10/64-in. choke from perforations at 7,830-38 ft. Total depth is 10,171 ft., with 5½-in. casing set at 7,919 ft.

Superior Oil Co. of California 1-B Miami Corp., at Pecan Lake field, Cameron Parish, was recompleted in perforations at 8,193-98 ft., flowing 25 bbl. of 51.9-gravity condensate through 10/64-in. choke. This well, discovery of the field, was deepened recently to 12,000 ft. and plugged back for the recompletion.

SOUTH LOUISIANA WILDCAT COMPLETIONS

Iberia Parish: The Texas Co. C-2 State Lease 334-Vermilion Bay, in Vermilion Bay-14s-5e, dry at 11,867 ft.

TEXAS GULF COAST

Sun Gets Two Producers In Fig Ridge Field

HOUSTON.—Sun Oil Co. has added two new producers in the Fig Ridge field of Chambers County and has staked location for another test in this rapidly growing field. Its 3-A O. H. Acom, Section 105, showed potential of 249 bbl. daily through 10/64-in. choke, flowing from 40 perforations at 8,545-55 ft. Its 5 S. W. Pipkin, Section 104, showed potential of 255 bbl. daily through 10/64-in. choke, from 60 perforations at 8,515-30 ft. The new location is 6 S. W. Pipkin in HT&B Survey, Section 104, an 8,575-ft. test.

Gulf Oil Corp. 1 (second hole) Williams et al Unit, in the Stowell field, Chambers County, is dual-completed with total depth 8,000 ft., and 5½-in. casing set at 7,757 ft. The upper sand flowed potential of 314 bbl. daily through perforations at 7,571-81 ft. The lower sand flowed potential of 303 bbl. daily through perforations at 7,616-26 ft.

American Republics and Houston Oil Co. of Texas 2 H&TC-fee, in the Beech Creek field, Hardin County, is waiting on cement to set with 7-in. casing at 6,373 ft. Total depth 10,218 ft. This test failed to pick up anything of interest in the Wilcox and will try for completion in the 6,240-ft. Cockfield discovery sand.

Cecil Hagen's 1 McKendry, southwest outpost at Thompson field, Fort Bend County, is running casing with total depth

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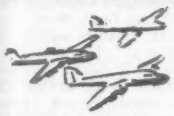

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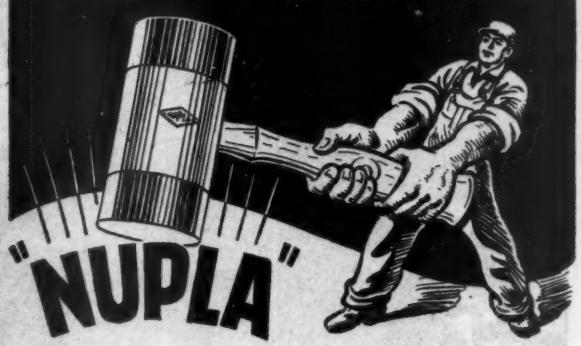

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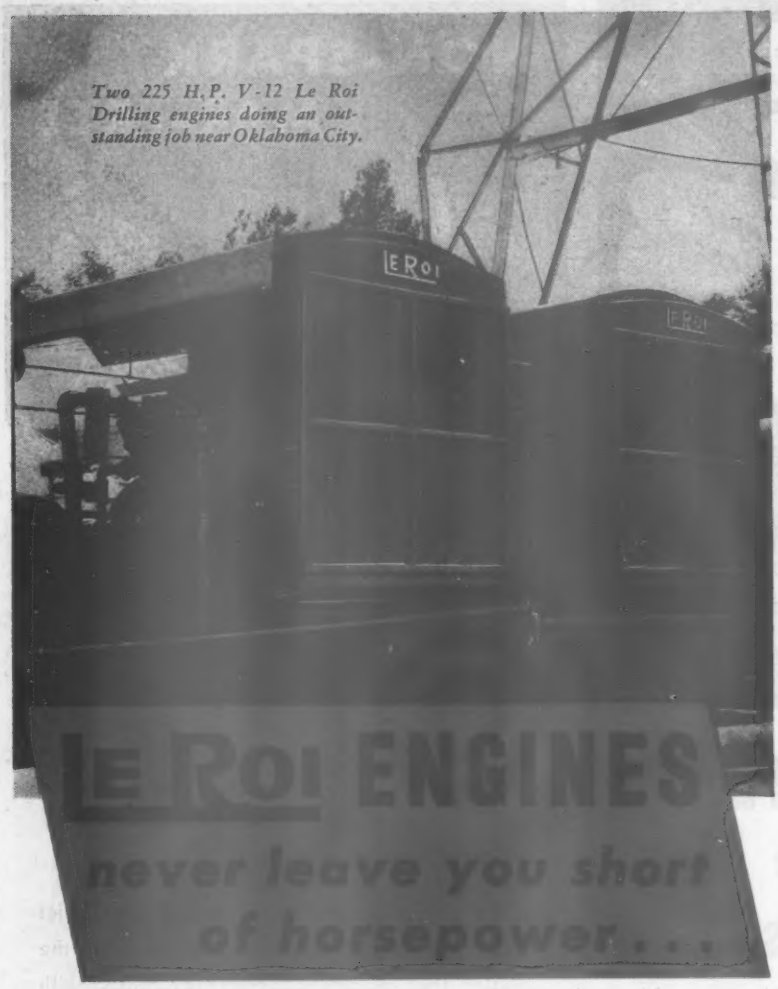

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5,450 ft., in oil sand. It is reported to have cored sand showing oil at 5,398-5,412 and 5,437-50 ft.

Pan American Production Co.'s 1 Danforth, in the Gillock field, Galveston County, was completed as a gas-distillate well with perforations at 7,882-7,906 ft. and is shut in for completion equipment. Total depth is 7,910 ft.

UPPER GULF COAST WILDCAT COMPLETIONS

Fort Bend County: W. J. Goldston 1 J. M. Moore estate, Needville area, Geo. Dedrich League, dry, at 7,275 ft.

Snake Creek Oil Corp. 1 Edward Schroeder, H. L. Belton Survey, 8 mi. southwest of Beasley, dry at 2,902 ft.

Texas Co. 1 Ernest Zwahr, Needville area, H&TC Sur., dry at 7,050 ft.

SOUTHWEST TEXAS

New Oil Sand Is Found by Humble in Gregory Field

CORPUS CHRISTI.—A new oil sand was opened by Humble Oil & Refining Co. 2 J. F. Green estate, in Gregory field, San Patricio County, in perforations at 8,503-05 ft. The test flowed a daily potential of 168.56 bbl. of oil. It is the first oil production in this area and is more than half a mile northeast of the 1 Green, discovery gas-condensate producer which was completed in perforations at 9,120-40 ft.

Stubbs, Foster & Deacon 1 Laddie and Joe Lundell, wildcat about 7 miles northeast of Austin in Travis County, is reported to have encountered shows at an unannounced depth and is testing in an effort to complete as an oil well. The well was a proposed 1,200-ft. test.

At North Keeran in Victoria County, Lyons and Prentiss 1 Keeran estate flowed at the rate of 8 bbl. an hour from perforations at 4,754-58 ft. Casing was set at 5,383 ft.

Continental Oil Co. 1 Victoria Albrecht et al, wildcat 3⅝ miles south of the Cabeza Creek Wilcox discovery in Goliad County, tested salt water in perforations at 8,692-8,704 ft. A squeeze job was made in perforations at 8,380-86 ft. and the well is waiting on cement to set. Total depth is 10,958 ft. with 5-in. liner set on bottom.

Henderson Coquat 1 Mrs. Idell Custer, outpost at Coquat field, Live Oak County, ran drill-stem test at 7,490-7,541 ft. using ¼-in. choke top and bottom, and 1,470-ft. water cushion. It recovered 390 ft. of cushion and 10 ft. of condensate with no bottom-hole pressure. It is now coring ahead from 7,569 ft.

SOUTHWEST TEXAS WILDCAT COMPLETIONS

Caldwell County: Magnolia Petroleum Co. 1 Bill Strawn, 2½ mi. north of Lytton Springs, James Montgomery Survey, dry at 1,575 ft.

Duval County: Cox, O'Neil, Yoakum & Hamon 1 Clara Driscoll, 18 mi. northwest of Benavides, in Santa Rosalia Rafael Ramirez Survey, dry at 4,015 ft.

Frio County: Kingwood Oil Co. 1 La Mesa Land & Cattle Co., 5 mi. south of Devine, Henry Castro Survey 79, dry at 3,849 ft.

Nueces County: Southern Minerals Corp. 1 R. A. Howze, 5 mi. east of Driscoll, J. E. Garrett subd. of Collins Petronilla Ranch, Share 5-G, dry at 7,512 ft.

Webb County: Westbrook Oil Co. 1 Mabel Adami, 2 mi. south of Adami field, John H. Gibson Survey, dry at 1,226 ft.

Zapata County: John B. Hardwicke 1 Arturo Ramires, N. G. Brown Sur., dry at 2,043 ft.

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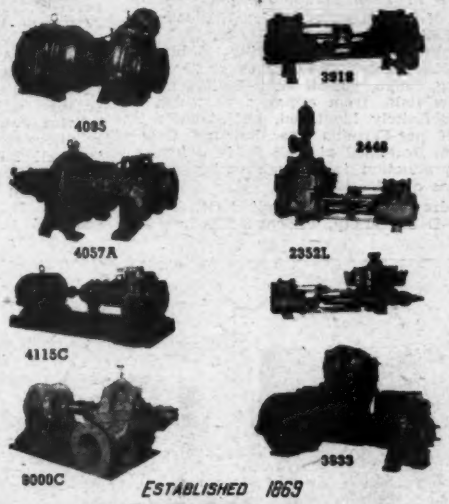

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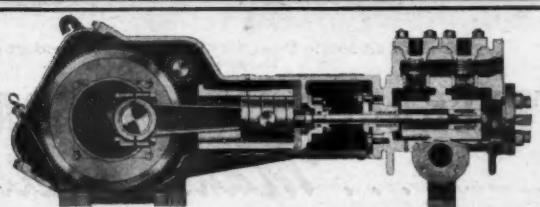

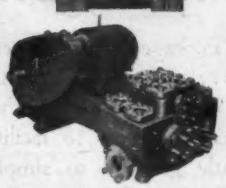

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PERMIAN BASIN

Humble Wildcat Opens Field in Pecos County

MIDLAND.—Humble Oil & Refining Co. 1 El Paso National Bank, wildcat west of Baldridge, in Section 7, Block 140, T&SLRR Survey, Pecos County, was brought in last week, flowing 198 bbl. of pipe-line oil in 12 hours through 29/64-in. tubing choke, gas-oil ratio 520. It opens a new field, from a pay zone which is not definitely identified, but thought to be of pre-Permian age, but not Ordovician. Bottomed at 5,463 ft. in dolomite, the production is through casing perforations at 5,435-49 ft.

Andrews County.—Stanolind Oil & Gas Co. 1-D University, wildcat 5 miles northwest of the Embar pool, has the earmarks of a discovery from the lower Permian. It found shows of oil in lime at six different levels, and then on a 90-minute drill-stem test at 7,532-7,609 ft. started showing gas in 25 minutes, recovered 360 ft. of mud heavily cut with oil and gas. A later test at 7,656-7,713 ft., open 1 hour, recovered 270 ft. of oil-cut and gas-cut mud. Cored at 7,713-31 ft., it recovered 7 ft. of dolomite with stains and fair porosity. It was coring ahead. Favorable structural position on upper beds was shown by Sun Oil Co. 1 Martin, Section 17, Block A-41, PSL Survey. With elevation of 3,314 ft., it topped anhydrite at 1,479 ft., checking from 80 to 200 ft. higher than adjacent dry holes.

Ector County.—Thickening of the newly discovered Devonian lime pay section in Shell Oil Co., Inc., and Cities Service Oil Co. 1 TXL was proved last week when it made a 75-minute drill-stem test at 7,954-78 ft., showing 500,000 cu. ft. of gas and flowed oil when the tool was closed, recovering 1,000 ft. of clean oil, 41-gravity. It drilled ahead below 8,018 ft. Two new Ordovician wildcats have been staked in Ector County. The Texas Co. 1 George C. Fraser "B" was spotted 4 miles south of the Shell-Cities Service discovery and 4 miles east of the Wheeler-Ellen field. A joint operation, to go to 8,500 ft., was staked by Texas and Phillips Petroleum Co. at 1 J. F. Cowden, in NW NE of Section 7, Block 44, T-1-N, T&PRR Survey, between the Embar and Goldsmith fields.

WEST TEXAS WILDCAT COMPLETIONS

Andrews County: Mid-Continent Petroleum 1-7 University, Sec. 20, Blk. 13, University lands, elev. 3,295 ft., anhydrite 1,680 ft., Cowden anhydrite 2,600 ft., Yates sand 2,865 ft., San Andres 4,290 ft., Glorietta 5,565 ft., pay 8,460 ft., flowed 3,744 bbl. day through ¾-in. choke, gas-oil ratio 500 to 1, 40° gravity, TD 8,957 ft. Pay in Devonian or Silurian.

The Texas Co. 1 E. B. Jones, Sec. 21, Blk. A-36, 6 mi. NW Andrews, elev. 3,163 ft., anhydrite 1,730 ft., Yates 2,820 ft., Brown lime 3,890 ft., San Andres 4,190 ft., plugged back to 4,490 ft., pay 4,365 ft., 154 bbl. day, 33.2° gravity, TD 6,242 ft.

Cochran County: Cherry & Kidd 1 W. A. Lewis, Labor 19, League 62, Midland CSL, 2½ mi. NW Whiteface, elev. 3,715 ft., pumped 184 bbl. day after acid, gas-oil ratio 121 to 1, 31.4° gravity, TD 4,878 ft.

San Andres Production Co. 1 M. N. Clauser, League 62, Labor 18, Midland CSL, 5½ mi. E Lehman, elev. 3,721 ft., San Andres 3,934 ft., pay 4,860 ft., pumped 187 bbl. day after acid, gas-oil ratio 600 to 1, 30° gravity, TD 4,875 ft.

Gaines County: Ray Albaugh 1 T. H. Scanlan est., Sec. 115, EL&RR Co. Sur., 3 mi. NE Cedar Lake pool, elev. 3,145 ft., anhydrite 2,080 ft., brown lime 3,970 ft., San Andres 4,590 ft., dry, TD 5,005 ft.

Garza County: Honolulu & Devonian 1 D. R. Payton, Sec. 1,421, WTRR Sur., 9 mi. NW Post, elev., 2,975 ft., anhydrite 1,397 ft., San Andres 2,845 ft., plugged back to 3,565 ft., TP 3,544 ft., pumped 131 bbl. day after acid, 34.5° gravity, TD 3,768 ft.

Pecos County: Humble 1 H. O. Word est., Sec. 4, Blk. 5, TCRR Sur., 9 mi. SE Fort Stockton, elev. 2,785 ft., Yates 2,190 ft., Wolfcamp 7,200-7,300 ft., dry, TD 9,150 ft.

Standard of Texas 2 Edith Trees et al, Sec. 27, Blk. 8, H&GN Sur., elev. 2,556 ft. anhydrite 1,560 ft., Rustler lime 1,690 ft., solid lime 2,890 ft., plugged back to 1,860 ft., dry, TD 8,200 ft.

Ward County: Stanolind 1-B Ruth Kaufman, Sec. 21, Blk. 5, H&TC Sur., elev. 2,505 ft., anhydrite 560 ft., Shipley lime 2,760 ft., San Andres 3,020 ft., Glorietta, 4,070 ft., dry, TD 4,500 ft.

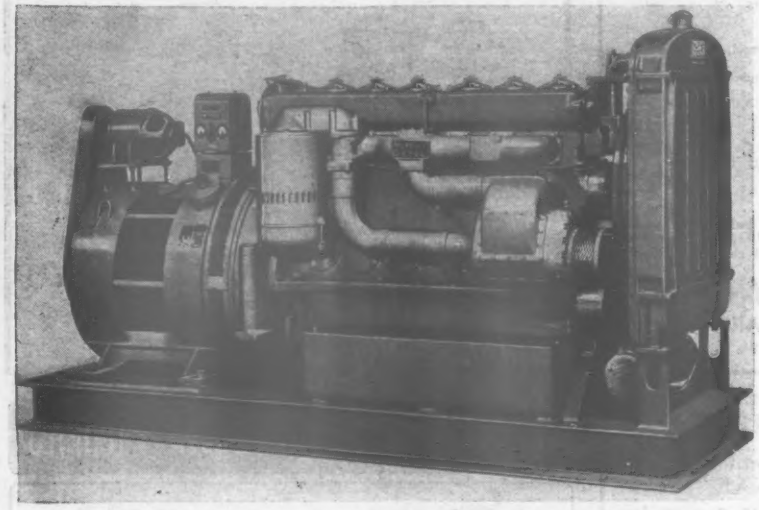
SOUTHEASTERN NEW MEXICO

HOBBS. — Opening of oil production from a deeper level appears likely at Barney Cockburn 1 Wyatt-State, a mile southeast of nearest production in the Maljamar field of western Lea County. Bottomed at 6,810 ft. in the Bone Springs section of the lower Permian lime, the well is reported to have filled about 1,500 ft. with oil and to have bailed oil at the rate of 4 bbl. an hour. A cable-tool operation, it previously had cemented a string of 7-in. pipe at 5,155 ft.

Humble Oil & Refining Co. 1 Federal-Leonard Oil Co., southeastern Lea County, was drilling at 11,599 ft. with no shows reported. DeKalb Agricultural Association 1 Phillips, SE SW 5-20-38, ¾ mile north of its 1 Magnolia-Stovall, small gas discovery, was drilling below 2,800 ft.

SOUTHEAST NEW MEXICO WILDCAT COMPLETIONS

Eddy County: H. E. Yates (was Hancock & Owen) 1 Crosby, C SW SW 33-19s-27e, elev. 3,433 ft., dry, TD 2,253 ft.



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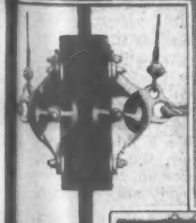

GRIZZLY

QUALITY OIL FIELD PRODUCTS

ROCKY MOUNTAIN

Tensleep Is Proven Productive at Gebo

DENVER. — Continental Oil Co. has a Tensleep discovery in its 3 Gebo unit, SW SE NW 23-44n-95w, Gebo dome, Hot Springs County, Wyoming. Seven-inch was cemented at 5,098 ft., and after drilling plug to 5,103 ft. it flowed 18 bbl. an hour on a 10-hour test. Top of Tensleep was approximately 4,887 ft. The upper section will be tested through perforated casing after which it will go back and test the Embar, which showed good saturation on the way down.

Good well at Rangely.—Ten years after the California Co. made a discovery in the Weber formation of Pennsylvanian age on the Rangely dome in western Colorado, that company has completed its second producer in that horizon, a much better well than the discovery, and the forerunner of an active development campaign. Its 1 Emerald, C NE SW 30-2n-102w, joint with the Equity Oil Co., had the top of the Weber at 5,578 ft., set the 7-in. at 5,575 ft., and drilled to 6,281 ft. The well flowed 170 bbl. of 35-gravity oil in 17 hours, through ¼-in. and ⅛-in. tubing chokes.

Discovery at Half Moon.—Husky Refining Co. has a possible discovery in the Embar and Tensleep horizons on the Half Moon structure in Park County, Wyoming, 8 miles west of Oregon Basin. Its 1 Krampert unit, NE SW NW 23-51n-102w, topped the Tensleep at 3,550 ft. after going through good saturation in the Embar, and found more saturation in the lower horizon. Casing is being set.

Kicking Horse gas discovery. — Husky Refining Co. 1 Rankin, a wildcat on the Kicking Horse structure, a closure on the north end of a plunging anticlinal nose extending from the east flank of the Kevin-Sunburst dome to the northeast, is a gas discovery estimated at 20,000,000 cu. ft. Location is NW SE SE 8-36n-1e, 8 miles northeast of the Kevin-Sunburst field.

Cooper Cove failure. — Stanolind Oil & Gas Co. 1 Union Pacific, NE SE NE 19-18n-77w, Cooper Cove district, Carbon County, Wyoming, had water in the Dakota at 4,913-5,000 ft. This test is ¾ mile northwest of the discovery well.

East Lance Creek wildcat.—Continental Oil Co. 2 Government, SW NE SE 29-36n-64w, East Lance Creek, which was completed for 72 bbl. of oil and 71 bbl. of water in 10 hours on a swabbing test from the first bench of the Dakota series at 3,990-4,009 ft., is ½ mile south of same company's 1 Leach, a gas discovery last December which gaged 8,848,000 cu. ft. at 3,808-95 ft. after plugging back from the Sundance.

WYOMING WILDCAT COMPLETIONS

Carbon County, Cooper Cove: Stanolind Oil & Gas 1 Union Pacific, NE SE NE 19-18n-77w, TD 5,000 ft., water in Dakota topped at 4,913 ft., dry.

Niobrara County, East Lance Creek: Continental Oil 2 Government, SW NE SE 29-36n-64w, TD 4,112 ft., 7-in. on bottom, water in second and third benches of Dakota, did not go to Lakota, set packer at 4,010 ft., perf. 80 holes at 3,990-4,009 ft. opposite first bench of Dakota, swabbed 72 bbl. 44.8-gravity oil and 71 bbl. water in 10-hour test, will put on pump.

MONTANA WILDCAT COMPLETIONS

Pondera County, Brady Block: Texas 1 Jesser, SE NW SE 17-27n-2w, TD 1,850 ft., sulfur water in Madison at 1,847-50 ft., dry.

Toole County, Kicking Horse: Husky Refining 1 Rankin, NW SE SE 8-36n-1e, TD 2,040 ft., 7-in. 1,960 ft., Ellis-Madison 2,040 ft., est. 20,000,000 cu. ft. gas at 560 lb. pressure.

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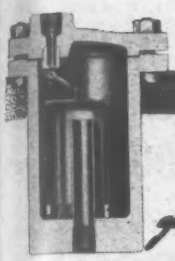
N. CENTRAL TEXAS

Texas Co. Wildcat Flows On Drill-Stem Test

WICHITA FALLS. — The Texas Co. 1 Rasure, northern Cooke County wildcat in the Sivels Bend of the Red River, about 11 miles northwest of the Walnut Bend pool, flowed oil for 10 minutes during a 20-minute drill-stem test at 6,759-88 ft. and recovered 900 ft. of oil and 100 ft. of mud in the drill pipe. An electrical survey indicated possible water in the pay section. The well was drilling ahead at 6,986 ft., logging dry sand at 6,798-6,810 ft. and broken sand from 6,940-86 ft. Texas Co. has staked location for a 3,800-ft. wildcat 6 miles southeast of Gainesville.

King County. — Humble 5 Ed Bateman has been completed from the new deep lime horizon in the Bateman field, flowing 206 bbl. of 35-gravity oil daily through ⅜-in. choke.

Throckmorton County. — Panhandle Refining Co. 1 W. B. Ewalt, Section 2170, TE&L Survey, topped Caddo lime at 4,152 ft., recovered 200 ft. of oil and 175 ft. of mud with brackish taste on a drill-stem test at 4,154-67 ft. and drilled ahead below 4,415 ft. Shell Oil Co., Inc., has staked 1 Hill & Allen for a 5,000-ft. wildcat 1 mile north of Throckmorton.



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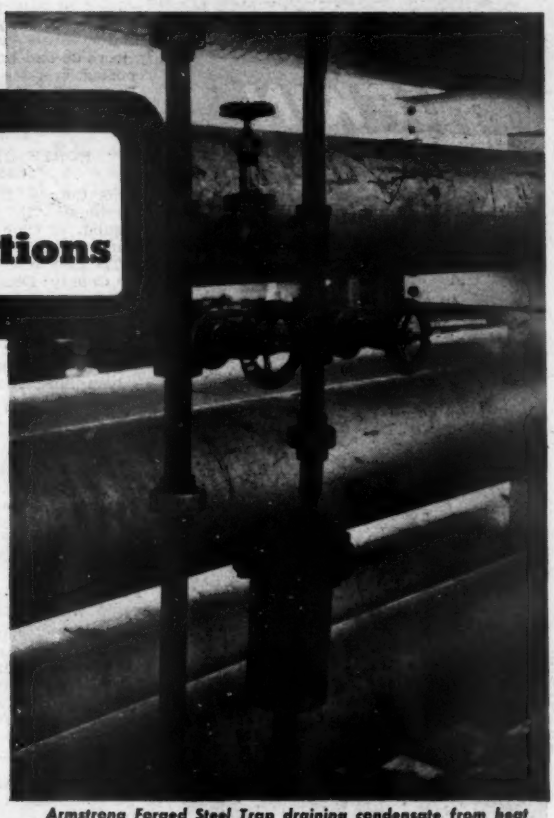

ARMSTRONG Forged Steel Traps are made primarily for high pressures — 450 lbs., 600 lbs., 900 lbs., 1500 lbs., 2400 lbs.— but more and more engineers are specifying them for both high and low pressures in their modern all-steel refinery installations. This trend away from all cast iron fittings is practical because Armstrong Forged Steel Traps provide both long lasting, dependable service and positive protection against fire or explosion hazards. Available in complete range of sizes to fit any individual need. Write today for Catalog H for details. ARMSTRONG MACHINE WORKS, 868 Maple Street, Three Rivers, Mich.

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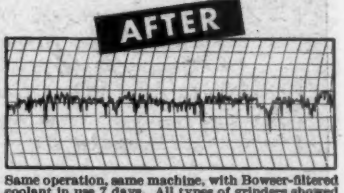
Surface variations after finish-grinding with unfiltered coolant prepared only 2 days previously. Scratches, scarcely visible, caused regrinding.



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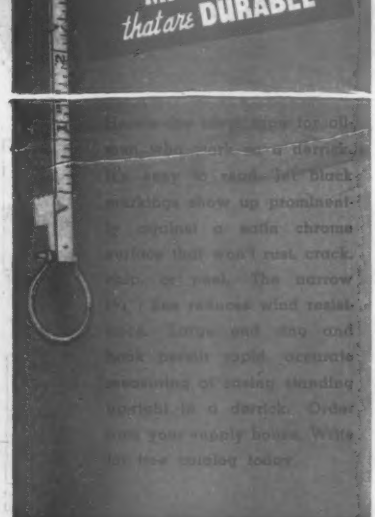

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TAPES • RULES • PRECISION TOOLS

Grayson County. — Pure Oil Co. 1-A Quinton Little was drilling below 6,079 ft. in shale and lime shells, with no shows reported.

Denton County. — Northern Ordnance Co. 1 D. W. Light, wildcat, is drilling past 3,348 ft.

NORTH TEXAS WILDCAT COMPLETIONS

Archer County: D. H. Bolin 1 C. L. Abercrombie "H," Blk. 153, J. W. Harris subd. of Club Ranch, 2 mi. S and ½ mi. W Archer City, elev. 1,051 ft., dry, TD 1,271 ft.

Clay County: Dean Bros. 1 G. W. Byers & Co., Blk. 2, Byers Bros. subd., 1 mi. N Petrolia, elev. 960 ft., 4 bbl. day, TD 826 ft.

Cooke County: E. R. Perkins and A. H. Harmon 1 Felix J. Becker, Wm. Oldham Sur., A-300, 3 mi. W Munster, elev. 1,079 ft., Ellenburger 2,830 ft., dry, TD 2,872 ft.

Paul B. Scott 1 A. D. Walterscheid, Eleanor Langford Sur., A-566, 4 mi. S Muenster, elev. 1,033 ft., 248 bbl. day, 39° gravity, TD 2,610 ft.

Jack County: Hanlon-Buchanan 1 Hensley-Martinez, Thos. Martinez Sur., A-388, 6 mi. S and 1 mi. E Jacksboro, Ellenburger 5,956 ft., dry dolomite, TD 6,156 ft.

WEST CENTRAL TEXAS

ABILENE. — Jones County's new pool opener, Merry Brothers and Perini and Alder Oil Co. 1 Herndon, 6 miles southwest of Anson in Section 19, Block 2, has been completed flowing 380 bbl. daily through tubing from the Flippen lime, which was topped at 2,382 ft., with saturation at 2,384-88 ft., total depth.

WEST CENTRAL TEXAS WILDCAT COMPLETIONS

Callahan County: R. S. Miesse 1 Joel Griffin, Sec. 27, BBB&C Sur., 3 mi. NE Clyde, elev. 1,949 ft., dry, TD 1,564 ft.

Shackelford County: Hickok & Reynolds 11-C J. H. Nail Est., Sec. 106, ETRR Sur., 11 mi. NW Albany, Bluff Creek sand 1,408-24 ft., coal 1,507-10 ft., Swastika sand 2,005-07 ft., dry, TD 2,010 ft.

ILLINOIS

Magnolia Opens New Pool In Clay County

CENTRALIA.—A new Cypress pool has been discovered in Clay County, 2 miles east of the nearest production in the Sailor Springs area, as Magnolia Petroleum Co. 1 M. Rinnert, NE NE NE 33-4n-8e, pumped 32 bbl. of oil and no water in 24 hours.

The Schnell pool in Richland County had an extension when Pure Oil Co. 1 Chafin "C," SW SW SW 1-2n-8e, was completed for 110 bbl. in the McClosky lime after acidizing with 5,000 gal. Elevation is reported at 410 ft., top of McClosky 2,970 ft., total depth 3,110 ft.

Seven new pool discoveries and four extensions to old pools during the month of August are listed by the Illinois Geological Survey. The new pools are: Thackeray in Hamilton County, New Haven West in Gallatin County, Roaches North and Boyd in Jefferson County, Sumner in Lawrence County, Calhoun in Richland County and Sailor Springs East in Clay County. This is the largest number of new pools opened in any one month for a long time.

Extensions were made to the Schnell pool in Clay County, Mount Carmel and Keensburg South pools in Wabash County, and New Haven North pool in White

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County. In addition, a new producing horizon, the Bethel sandstone, was found in the Roaches North pool in Jefferson County.

ILLINOIS WILDCAT COMPLETIONS

Clay County: Magnolia 1 Rinnert, NE NE NE 33-4n-8e, pumped 32 bbl. per day from pay zone 2,690-2,700 ft., TD 2,716 ft., Cypress 2,690 ft.

Jasper County: Central Pipe Line 1 Souers, SW SW NW 7-8n-9e, dry, TD 2,870 ft., Ste. Genevieve 2,732 ft., St. Louis 2,863 ft.

Jefferson County: Shell 1 Davis, NW NE NE 23-4s-3e, dry, TD 3,187 ft., Aux Vases 2,928 ft., Ste. Genevieve 2,988 ft.

MISSISSIPPI

Jeff Davis County Test Is Flowing 87 Bbl. Condensate

JACKSON.—S. W. Richardson 1 Berry, SE NW 24-9n-19w, Jeff Davis County condensate discovery, is continuing tests and is flowing 87 bbl. of condensate with large volumes of gas.

The California Co.'s new pool in Lincoln County, southeast of Brookhaven, has been officially named the Mallalieu pool. East and west offsets have been staked by the California Co.

In Copiah County, Amerada Petroleum Corp. 1 Earlow, SE NW NW 2-10n-5e, was dry at 10,163 ft., in Lower Cretaceous after testing the Massive sand topped at 10,032 ft.

In Jasper County, Southland Co. 1 Maske, SW NW 14-3n-12e, is dry at 6,165 ft., after testing Massive sand topped at 6,052 ft.

In Lamar County, Alabama, Stanolind Oil & Gas Co. 1-A Woods, a wildcat in NE SE 23-14s-15w, has been abandoned at 3,170 ft. in chert. Tops reported are Tuscambia 3,060 ft., Ft. Payne 3,145 ft.

ALABAMA WILDCAT COMPLETIONS

Washington County: Texas 1 Odom, SE SE 27-4n-3w, dry, TD 8,240 ft.

LA.-ARK.

21 Active Wildcat Tests In Arkansas

MAGNOLIA.—Two wildcat tests were abandoned this week, but two more were started, to keep the number of active tests in Arkansas at 21, scattered through 13 counties. In Chicot County, Placid Oil Co. 1 Cox-Wilson, SE SE 34-17s-2w, was started, while the second new start was Lion Oil & Refining Co.'s 1 Griggs, NW SE 23-10n-13w, in Van Buren County.

NORTHERN LOUISIANA WILDCAT COMPLETIONS

Caddo Parish: C. W. Beene et al 1 Williams, 300 ft. N, 360 ft. E of C 25-15n-15w, dry, TD 1,121 ft.

DeSoto Parish: A. W. Phillips et al 1-A Anthony, approx. SE NE 9-11n-14w, 75,000,000 cu. ft. gas from pay zone 4,876-80 ft., TD 5,007 ft., Rodessa 4,876 ft.

ARKANSAS WILDCAT COMPLETIONS

Columbia County: McAlester Fuel 1 Luck estate, NE NE 9-16s-20w, dry, TD 6,950 ft.

Little River County: H. H. Temple 1 Dierks Lumber & Coal, NW SW 30-11s-30w, dry, TD 858 ft.

MICHIGAN

Drilling Is Stimulated by New Spacing Regulation

SAGINAW.—Petroleum Administration for War's decision to permit 10-acre spacing for wells up to a depth of 1,650 ft. in 12 southwest Michigan counties was followed immediately by an increase in drilling projects. Nine of 21 state drilling permits issued in the past week are for Allegan tests.

Oil leasing of state lands set a record as a result of the offering of mineral rights on 61,000 acres of state-owned lands, expected to bring the total this year to more than the 195,819 acres leased in 1943. Drillers, buying the leases for wildcatting, are paying less. Bonuses on state lands leased this year prior to the auction this week amounted to $99,000, compared with $180,000 last year.

Operators reported 14 completions for the past week, 10 being dry holes, including 7 wildcat tests. Among the three oil producers Sun Oil Co.'s 1 Church in Section 1, Chippewa Township, Mecosta County, had a daily potential of about 2,000 bbl. One gas well was on the list.

Conservation Department permits, in addition to the nine for Allegan County, included three for Mecosta, two each for Newaygo and Ottawa, one each for Isabella, Van Buren, Gratiot, Ionia and Clare.

MICHIGAN WILDCAT COMPLETIONS

Allegan County, Lee Township: Max Spi-

(Continued on page 125)

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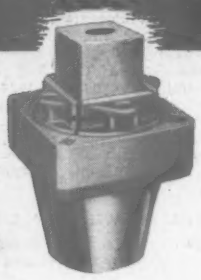

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Among the Drilling Contractors

Beacon Drilling Co. has the contract on the Sinclair Prairie Oil Co. 1 Perkins, in C SE NW 11-9n-24w, Beckham County, Oklahoma, which was drilling around 900 ft. The contract is for 6,500 ft.

Markham Drilling Co., of Ada, Okla., has the drilling contract on the Magnolia Petroleum Co. 1 Williams, in C SW SE 6-6s-3w, near Orr in the extreme northwest corner of Love County, Oklahoma. This is a new wildcat test starting. Cellar and pits were being dug.

Rine Drilling Co., Great Bend, Kans., is drilling the Sunray Oil Corp. 1 Christianson, in SE SE NW 3-15-20w, Ellis County, Kansas. The test, which is drilling below 1,000 ft., is on a block of 1,680 acres.

Bevo Drilling Co., organized in California to engage in contract drilling, will maintain offices in Wilmington, Calif.

Jenks-Kent Drilling Co., Whittier, Calif., has been organized by Abbott B. Jenks and Hugh M. Kent to engage in contract drilling in California fields.

The T. P. Pike Drilling Co. has been awarded contract to drill a new well on the Newhall Land & Farming Co. property in the Del Valle area for the joint account of British American Oil Producing Co. and The Texas Co. in 21-4n-17w.

E. V. Hilliard is the contractor on the Mueller Brass Co. 1 Wm. Van Antwerp, in NE SE NW 9-6n-17e, St. Clair County, Michigan.

Roy Sanders is the contractor on the Morris J. Weinberg 2 Harry Minshall, in NW SE NW 21-2s-16w, Van Buren County, Michigan.

J. W. Spencer is the contractor on the Walter A. Elliott 2 L. J. Fellows, in NW NW SW 22-1s-16w, Van Buren County, Michigan.

Harbar Drilling Co., Wichita, Kans., has the contract on the Falcon-Seaboard Drilling Co. 1 Hitz, in CNL NW NW 28-22-12w, Stafford County, Kansas. The test has been staked 1 mile southwest of the Spangenberg pool and on a block of 240 acres assembled by Falcon-Seaboard. The contractor has half interest in test.

Gillespie & Lobaugh have the drilling contract on the Davon Oil Co. 1 McLaurey, a new operation in northern Lincoln County, Oklahoma. The location is SE NE NE 33-17n-5e, east of the Agra pool. The contractors have an interest in the well and the 460-acre spread.

Gabbert Drilling Co., of Great Bend, Kans., has the drilling contract on the Doley Oil Co. 1 Kern, a 3,600-ft. or Arbuckle lime test midway between the Morel and Berry pools of Rooks County, Kansas. The test is in NW NW SW 11-9-20w.

R. A. Wells is the contractor on the 1 Linter-Rich Communitized, in NW SW NW 33-9n-5w, Montcalm County, Michigan.

Three B Drilling Co. has been organized by W. B. Crissman and M. B. Maze and offices established at Bakersfield, Calif.

Lupher Drilling Co. will drill three tests for Sohio Petroleum Co. in Isabella County, Michigan, and another in the same county for Nollem Oil & Gas Corp. The Sohio tests are the 2 John Cummings, in C N½ SW SW 28-16n-6w; the 3 John Cummings, in N½ NE NE 32-16n-6w, and the 4 John Cummings, in N½ NE NE 32-16n-6w. The Nollem test is the 1 Lewis Thayer, in NW SE SE 22-16n-4w.

E. W. Leeder has been awarded the drilling contract on the Stanley L. Findley 1 Cornelius Maynard, in NW NW NW 13-4n-14w, Allegan County, Michigan.

Union Drilling & Producing Co. will drill the Panhandle Eastern Pipe Line Co. 1 E. C. Addison, in C W½ NW NW 11-3n-3e, Livingston County, Michigan.

Thumb Drilling Co. is the contractor on the Wallace Markle 1 Thomas Inwood, in NE NE SW 8-17n-14e, Huron County, Michigan.

WILDCAT COMPLETIONS AND DISCOVERIES

	Week ended September 2, 1944					Cumulative total, 1944				
	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ohio	1	0	0	1	2	1	0	12	46	59
Indiana	0	0	0	0	0	3	0	0	18	21
Illinois	1	0	0	2	3	23	0	0	215	238
Kentucky	3	0	0	3	6	12	0	0	57	69
Michigan	1	0	0	7	8	9	0	2	170	181
Kansas	1	0	1	7	9	37	0	6	290	333
Nebraska-Missouri-Iowa	0	0	0	0	0	1	0	0	9	10
Oklahoma	1	0	1	10	12	41	0	19	179	239
Texas:										
North Central	2	0	0	5	7	47	0	1	210	258
West	5	0	0	4	9	26	0	3	117	146
Panhandle	0	0	0	0	0	0	0	1	8	9
Eastern	0	0	0	0	0	5	0	1	84	90
Gulf Coast	0	0	0	3	3	26	9	13	157	205
Southwest	0	0	0	6	6	18	4	14	161	197
Total Texas	7	0	0	18	25	122	13	33	737	905
Louisiana:										
Northern	0	0	1	1	2	3	0	1	38	42
Southern	0	0	0	1	1	5	6	0	36	47
Total Louisiana	0	0	1	2	3	8	6	1	74	89
Arkansas	0	0	0	2	2	2	1	0	43	46
Mississippi	0	0	0	0	0	2	0	0	46	48
Alabama-Georgia-Florida	0	0	0	1	1	2	0	0	14	16
Montana	0	0	1	1	2	3	0	2	28	33
Wyoming	1	0	0	1	2	12	0	1	14	27
Colorado-Utah	0	0	0	0	0	2	0	1	22	25
New Mexico	0	0	0	1	1	4	0	3	39	46
California	0	0	1	5	6	4	0	6	138	148
Total United States	16	0	5	61	82	288	20	86	2,139	2,533
Total previous week	8	0	2	70	80					

OHIO, KENTUCKY

Oriskany Test Plugged Back Produces From Warren

COLUMBUS.—South Penn Oil Co. completed 1 George Kerr, Section 6, Center Township, Monroe County, as a Warren sand producer, after drilling through the Oriskany at 5,514-83 ft., with no shows, plugging back to 3,060 ft. and shooting. Production is 3 bbl. with 100,000 cu. ft. gas.

Ohio Fuel Gas Co. completed a 2,940,000-cu. ft. well on D. M. Caughenbaugh, Section 10, Madison Township, Perry County, after drilling 13 ft. in sand to 3,305 ft.

Another good well in the south part of the Richville pool was completed by Obermiller on the Jas. Platt lease, Section 1, Bethlehem Township, Stark County. Clinton sand at 4,462-4,550 ft. gaged 848,000 cu. ft. natural and shut in at 1,660,000 after shot.

OHIO WILDCAT COMPLETIONS

Lorain County, Wellington Township: Harmon 1 G. B. Warner, Lot 26, Clinton, no sand, dry, TD 2,383 ft.

Monroe County, Center Township: South Penn 1 Geo. Kerr, Sec. 6, Warren 3,057-3,062 ft., 3 bbl., Oriskany 5,514-5,583 ft., dry, TD 5,620 ft., plugged back to 3,060 ft.

EASTERN KENTUCKY

ASHLAND.—Two oil wells and one gas well were completed in eastern Kentucky during the past week. Activities pointed slightly upward with several new locations filed. Several wells have reached or are near completion levels.

J. W. Turner treated No. 1 on the A. J. Allen No. 2 tract in Elliott County at 979 ft. and has an estimated daily production of 5 bbl. of oil. Virginia Gasoline & Oil Co. completed No. 1 on the Lace Steep land in Martin County at total depth of 1,350 ft. It has an estimated daily production of 10 bbl. Kentucky-West Virginia Gas Co. completed No. 760 on the Don J. Syck tract in Pike County at 1,769 ft. with a daily open flow of 869,000 cu. ft. of gas from the Maxon.

WESTERN KENTUCKY

OWENSBORO.—Western Kentucky had one of its best weeks of the year to date, with three successful wildcats against three failures. Union County had two successful hits, Texas Co. et al 1 Culver, 12-P-20, 4 miles northeast of Uniontown being completed for 13 bbl. on the pump from the O'Hara pay at 2,521-26 ft., while Ashland Oil & Refining et al 1 Spink, 22-P-19, made 150 bbl. from the Waltersburg at 1,752 ft.

In Webster County, Carl Seneff 1 Clark Mitchell (T. Page Sur.), 9-L-21, found a Pennsylvanian sand at 1,004-26 ft., which had not produced anywhere else in this district and pumped 124 bbl. per day.

New operations announced totaled 14, including two new wildcat starts, Sohio Petroleum 1 Walker, SW NW SW 5-N-25 in Henderson County, and Cameron 1 Simpson, 23-P-19, a ½-mile west outpost, in Union County.

KENTUCKY WILDCAT COMPLETIONS

Caldwell County: Sohio 1 Vinson, NE NE SW 16-J-20, 8 mi. N of Princeton, dry, TD 1,290 ft., elev. 522 ft.

Daviess County: Shell I Hamilton, NW NW 14-O-27, dry, TD 2,358 ft., Renault 2,038 ft., Ste. Genevieve 2,154 ft., McCloskey 2,196 ft.

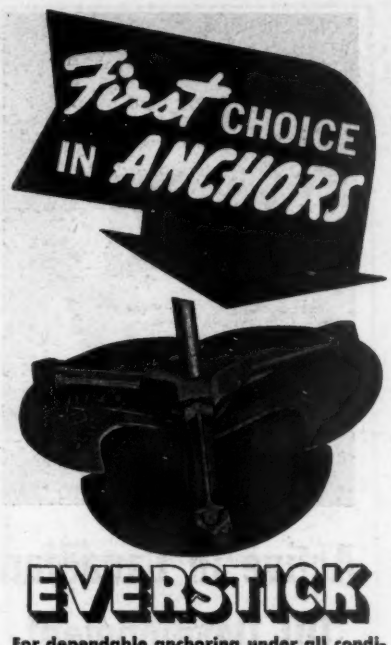
Henderson County: Sun 1 Overfield, NE¼ 1-N-22, 1½ mi. SE of Dixie, dry, TD 2,723 ft., elev. 453 ft., Renault 2,451 ft., Ste. Genevieve 2,573 ft.

Union County: Texas et al 1 Culver, 12-P-

(Continued on page 125)

LEGAL

Notice of Oil & Gas lease sale: The U.S. Department of Agriculture will award leases on 15 tracts of approximately 2480 acres in Cochran County, Texas, on former Slaughter Ranch. Rent $1.00 per acre Awards limited to 1 tract per lessee. Sealed bids to be publicly opened September 15. Bid forms and additional information can be secured from Ray E. Davis, Acting Regional Director, Farm Security Administration, Old Post Office Building, Amarillo, Texas. Permission may be obtained from Mr. Davis for making preliminary geophysical and geological surveys upon written request.



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For dependable anchoring under all conditions, use Eversticks. Made of tough, rust-resistant, malleable iron . . . quick and easy to install . . . expand in undisturbed earth. Preferred by engineers and crews alike. Write for latest Everstick bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

COUNT ON
DEVIL DOG No. 3
for WAR and
for VICTORY

No. 3 Devil Dog A. P. I. 3

Jeffrey contributes 65 years of chain-building experience to make oil well chain a dependable adjunct to the national war effort.

THE JEFFREY MFG. CO.
891-99 N. FOURTH ST., COLUMBUS, O.
Texas Sales Office: 6358 Auden St., Houston

PERSONALS

Active in Canadian Oil Development Since 1919

OLIVER B. HOPKINS, Ph.D., recently appointed a vice president of Imperial Oil, Ltd., has been associated with oil development in Canada since 1919. Born in Harrisonburg, Va., Dr. Hopkins was educated at Baltimore City College and Johns Hopkins University, graduating from the latter in 1909 with an A.B. and receiving his doctorate in 1912.

In the latter year Dr. Hopkins became assistant state geologist of Georgia. Two years later he joined U. S. Geological Survey, serving first as assistant geologist and then as geologist. In 1919 he obtained leave of absence and worked for Imperial Oil in western Canada, doing reconnaissance work in the foothills of the Rockies.

His leave of absence was extended, and in 1920 Dr. Hopkins went to Colombia to investigate the oil prospects of the De Mares Concession, purchase of which International Petroleum Co., Ltd., controlled by Imperial, was considering. In that same year he resigned from the survey and became chief geologist of Imperial Oil.

After organizing the geological department of International Petroleum in Peru, Dr. Hopkins returned to Canada, where he administered the geological and lands department of Imperial Oil and International Petroleum, continuing as chief geologist of Imperial until his recent appointment to a vice presidency, in charge of exploration and production.

H. P. Barton, formerly president of General-Penn Refining Co., Baltimore; **Ralph T. Bratt,** one-time supervisor of oil burner and fuel oil sales in the Hackensack district for Standard Oil Co. of New Jersey; **Robert J. Finigan,** a mechanical engineer in the Bayway refinery of the same company, and **Robert H. Hahn,** formerly a research chemist at the Sugar Creek, Mo., refinery of Standard Oil Co. of Indiana, have been promoted to the grade of major in the fuels and lubricants division, office of the quartermaster general, in Washington. Advanced to captaincies are **James S. Clarke,** engineer in the process engineering department, Standard Oil Development Co.; **William R. Cone,** sales department, Fargo division, Standard Oil Co. of Indiana; **Charles V. Kolt,** transportation department, Mene Grande Oil Co., Venezuela; **Carl L. Mayhall, Jr.,** sales and marketing department, Anderson-Prichard Oil Corp., Oklahoma City; **Don D. Montgomery,** consulting petroleum geologist in Oklahoma and Arkansas, and **Scott L. Reeburgh,** chemical engineer, Port Arthur refinery, Gulf Oil Corp.

Rufus M. Smith, formerly geologist for Panhandle Eastern Pipe Line Co., Kansas City, Mo., is now a lieutenant in the U. S. Naval Reserve. Lieutenant Smith at present is in the indoctrination school at Princeton, N. J.

Paul G. Benedum, president of Bentex Oil Corp. and Houston representative of the Benedum-Trees oil interests, has been promoted from major to lieutenant colonel. He is head of the aviation-fuel branch of the Ninth Corps Area, Army Air Forces, stationed in Washington.

Robert B. Curran, assistant to the president of The Carter Oil Co., Tulsa, has been named assistant manager of Carter's northwest division, with headquarters in Billings, Mont., and will assume his new post September 15. Curran graduated in 1933 from University of Oklahoma with a degree in geology, joined Carter, and soon was made production geologist in the Seminole field. He was made chief scout in 1939 and head of the scouting and statistical division in 1941. He was advanced to his present position in 1943.

C. D. Watson, on special assignment for The Carter Oil Co. in Washington since January 1942, has returned to his former administrative duties in Tulsa. He became a director of the company in 1936, in charge of conservation matters with state regulatory bodies. He resumed these and additional duties following his return to regular company service last week.

John Van Dall has resigned as Oklahoma district geologist for Magnolia Petroleum Co. to take over management of stripper properties of G. I. and W. E. Van Dall in northeastern Oklahoma. His headquarters will be in Bartlesville. **Walter L. Moreman,** who was his assistant, has been promoted to Oklahoma district geologist for Magnolia, with headquarters in Oklahoma City.

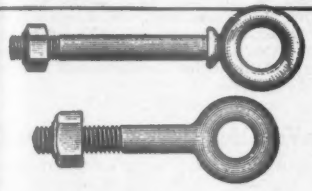
Lester F. Danforth, Tulsa, graduate of University of Oklahoma, has been advanced to captain in the Quartermaster Corps. Prior to entering war service he was in charge of materials and warehouses for Halliburton Oil Well Cementing Co., Duncan, Okla.

Coxey Evans will continue as Illinois production superintendent for Cities Service Oil Co., which has transferred its state headquarters to Olney. The production department was in Albion, and the land and geological departments were in Mattoon. **Lindsey G. Morgan** heads the geological department and **Robert V. Dillman** the land department.

N. C. McGowen, Shreveport, for years president of the principal subsidiaries of United Gas Corp., has been elected president of the parent organization to succeed J. H. Gill, who died recently. **R. H. Hargrove** was elected vice president. **A. B. Paterson,** president New Orleans Public Service, Inc.; **W. T. Wynn,** of Greenville, Miss., and **C. J. Savoie** of Belle Rose, La., were named directors.

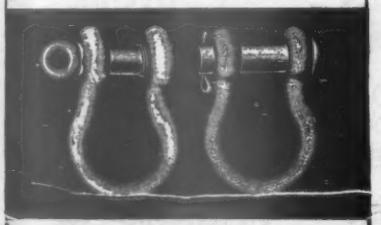
HERE'S A LINK
FREE FROM PLAY
OR
SHEARING ACTION
ON THE RIVET

Laughlin's drop-forged, heat-treated "Missing Link" is matched under pressure . . . so there is no play between the halves, no shearing action on the rivet. Under stress, the rivet merely holds the missing link together. The interlocking lugs take the load.



WIDE RANGE OF EYE BOLTS

Laughlin's drop-forged, weldless eye bolts are available in any length or diameter, with or without thread or shoulder. Galvanized or Plain. Stock sizes: ¼" x 2" to 1¼" x 20".



SHACKLES MADE TO
U. S. GOVERNMENT TOLERANCES

Drop-forged steel, weldless anchor shackles, made in all sizes from 3/16" to 2½". Can be furnished with either screw pin, round pin or bolt and nut. Galvanized or Plain-finish.

Look for Laughlin Products in Composite Catalog

Distributed through
Mill, Mine, and Oil Field Supply Houses

FORGING A SHARE IN VICTORY

THE THOMAS LAUGHLIN Company
PORTLAND 6, MAINE

CANADIAN FIELDS

North Central Portion of Turner Valley Adds Well

CHATHAM. — Interest in Turner Valley has shifted to the previously low-production north central area where Royalite Oil 75, LSD 6, 2-20-3w5, had Madison lime at 8,290-8,537 ft., flowed 100 bbl. per hour after acidizing.

South Turner Valley. — Major-National 16, LSD 4, 9-18-2w5, outpost test to the south, had the Madison at 7,825-8,362 ft. and made 14 bbl. after first acid wash.

North extension.—In the Turner Valley north extension, Foothills Oil & Gas 18, LSD 5, 9-21-3w5, made 505 bbl. daily from Madison at 8,492-8,884 ft.

Viking-Kinsella. — In the north-central plains area of Alberta, Hudson Bay Oil & Gas 1, LSD 5, 8-49-12w4, finished at 3,039 ft., abandoned. Imperial-Viking 3, finished at 2,938 ft., abandoned.

Michigan

(Continued from page 121)

del 1 J. B. Balch, NW NE SE 15-1n-15w, dry at 1,370 ft.

Hopkins Township: Voorhees Drilling Co. 1 W. W. and W. Wander Kolk, SE SW NW 27-3n-12w, dry at 1,752 ft.

Gladwin County, Clemcnt Township: J. V. Wicklund Development Co. 1 Charles H. Sumner, NW SE SW 25-20n-1e, dry at 3,531 ft.

Mecosta County, Chippewa Township: Sun Oil Co. 1 Dorus Church, C S½ SW SW 1-16n-8w, 235 bbl. first 3 hours, in Dundee, TD 3,917 ft.

Montcalm County, Day Township: Leslie T. Barber 1 Hovinga, SW NE SW 5-11n-6w, dry at 1,383 ft.

Newaygo County, Bridgeton Township: Charles D. Hoffman 1 Consumers Power Co., C S½ SE NE 28-11n-14w, dry at 2,068 ft.

Osceola County, Orient Township: National Utilities Co. of Michigan 1 Omar Huff, C SW 31-17n-7w, dry at 1,525 ft.

Ottawa County, Olive Township: Zan Oil, Tr., 1 J. Westrate, NE NE SE 34-6n-15w, dry at 1,642 ft.

Western Kentucky

(Continued from page 123)

20, 4 mi. NE of Uniontown, pumped 13 bbl. per day from pay zone 2,521-26 ft., TD 2,710 ft., O'Hara 2,521 ft.

Ashland et al 1 Spink, 22-P-19, 150 bbl. per day from pay zone 1,752-92 ft., TD 1,792 ft., elev. 380 ft., Waltersburg 1,752 ft.

Webster County: Carl Seneff 1 Clark-Mitchell, (T. Page Sur.) 9-L-21, southeast corner of farm, pumped 124 bbl. per day from pay zone 1,004-26 ft., discovery, TD 1,026 ft., Pennsylvanian sand 1,004 ft.

INDIANA

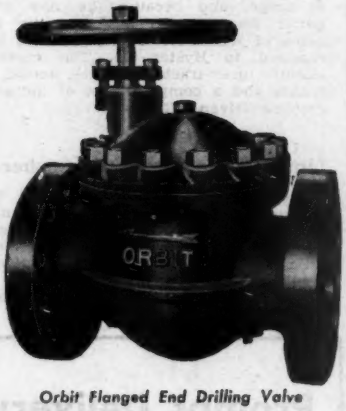
EVANSVILLE.—Interest is rising in the area 5 miles west of Mount Vernon as Ashland Oil & Refining et al 3 Joe W. Mann, NW NE NW 5-7s-14w, came in flowing 18 bbl. per hour, natural, through a 1-in. choke from the Waltersburg sand at 2,063-96 ft. This follows on the heels of the completion last week of the same company's 2 Mann for 800 bbl. per day. The 2 Mann is located 530 ft. from north line and 330 ft. from west line of NE NW 5-7s-14w, and had the Waltersberg at 2,096-2,110 ft.

Activity is picking up in the state, 12 new operations being announced compared to four completions.

ORBIT

DRILLING VALVES
ARE QUICK OPENING

ONLY 2½ to 5 TURNS ARE REQUIRED TO FULLY OPEN OR CLOSE THE ORBIT DRILLING VALVE. THE SEATS ARE PROTECTED AGAINST DAMAGE FROM DRILLING TOOLS AND WIRE LINES.



Orbit Flanged End Drilling Valve

ORBIT DRILLING VALVES ARE AVAILABLE IN BOTH FULL OPENING AND NOMINAL OPENING SIZES. WITH FLANGED OR SCREWED ENDS.

See pages 2194 to 2211 in 1944 Composite Catalog

ORBIT VALVES

OIL WELL IMPROVEMENTS CO.
Since 1912
Tulsa, Oklahoma

Industrial Items

Decal Locator Sign for Plant Fire Extinguishers

Randolph Laboratories, Inc., 8 East Kinzie Street, Chicago, has developed a new extinguisher locator sign; a decal water-transfer that can be instantly placed above all extinguishers in the plant area.

This 10-in. diameter locator, printed in large white letters on a bright red background, is visible for 75 ft. in any part of the plant.

Hyster Co. Drops Willamette From Corporation Name

Because the old name has outgrown its original importance with both manufacturing and sales locations now national in scope, and because the new name better describes its products, the firm name of Willamette Hyster Co. has been changed to Hyster Co. The company manufactures tractor winches, hoists, and cranes and a complete line of industrial gasoline-driven lift trucks.

Liquid Type Fire Extinguisher

A light-weight vaporizing liquid type fire extinguisher is offered by General Detroit Corp., 2270 East Jefferson Avenue, Detroit. One of the outstanding features claimed for this fire fighter is a patented "Safety Phlare" design of the lower end of the pump cylinder. The cylinder is expanded at the bottom to insure immediate free-floating piston action even after long periods of disuse. Yet in the remainder of the cylinder felts fit snugly to insure top operating efficiency. Absence of metal-to-metal contact in the expanded section eliminates the possibility of piston sticking to cylinder wall.

Other features include a panicproof safety lock actuated by turning handle either right or left. Locking shoulders are pyramid shape for easy turning. Cap, stuffing box, handle lock, and handle seal are a single piece brass drop forging eliminating all interior soldered joints.

Mensing Assistant Treasurer For National Supply Co.

National Supply Co. announces the election of John B. Mensing as assistant treasurer. He has been associated with the company for 25 years.

LaLande Research Director For Pennsylvania Salt

Dr. William A. LaLande, Jr., formerly director of research of Attapulgus Clay Co., has joined the research and development department of Pennsylvania Salt Manufacturing Co. as director of research, according to announcement by Dr. S. C. Ogburn, Jr., manager of research and development. He will have immediate charge of the research division.

Firm Enters Oil and Gas Well Chemical Service

Acid Engineering Co., 2406 Dawson Road, Tulsa, has entered the oil and gas well chemical service and will do acidizing of wells and industrial equipment throughout northeastern Oklahoma, under license from Dowell, Inc.

E. S. (Jack) Villines is general manager of the new firm. He formerly served as production engineer with Shell Petroleum Corp. until 1937 after which he spent 7 years in Oklahoma and Texas for Dowell, Inc. At time of his recent resignation he was district service engineer for Dowell in West Texas.

Seibert Export Representative For Buda Co.

G. W. Seibert is export representative for Buda Co., Export Oil Field Division, and is located at 253 West Sixty-fourth Street, New York 23. The Buda export offices were formerly located at 149 Broadway, New York City.

Mason Goes to National Tube

Louis W. Mason, formerly purchasing agent of Tubular Alloy Steel Corp., in Gary, Ind., has been appointed assistant to general manager of sales of National Tube Co., another U. S. Steel subsidiary. He will make his headquarters in Washington, D. C.

LeVan Heads Haynes Stellite Co.

E. E. LeVan has been elected president of Haynes Stellite Co., a unit of Union Carbide & Carbon Corp., succeeding the late Francis P. Gormely.

Prompt Delivery—
CRITICAL EQUIPMENT!

7500' Used Power Rig—with Wilson "Atlas" drawworks equipped with Hydromatic Brake; two model 1879 Buda gas-butane engines; model 7¼ PHD Oilwell pump. This rig is complete in every detail and has had excellent care. ***Available about October 1st.***

Rebuilt Wilson-Snyder 7¼" x 10" Heavy Duty Power Pump—This pump has been completely reconditioned. See it at our Odessa, Texas, Store.

New Drill Collars—Shipments against our stock orders will begin arriving about September 15th, and will continue regularly thereafter.

New 650 HP Reverse Clutch—We have in stock at Oklahoma City one model B-4850-S Lucey Reverse Clutch.

These are examples of our ability to quickly supply critical equipment. Contact us—we'll do our best to be helpful.

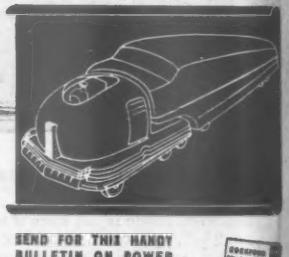
LUCEY PRODUCTS CORPORATION
OIL WELL SUPPLIES
TULSA, OKLAHOMA

ROCKFORD
Spring Loaded
CLUTCHES

provide convenient control and smooth gear changes—maintaining disengagement by light foot-pedal pressure. Consult our engineers freely concerning advantageous use of ROCFORD Spring Loaded CLUTCH features in your new and improved models.

HOW "HALF-TRACK" Clutch-Control WILL HELP IMPROVE the Mobility of TANK TYPE TRUCKS

—and develope streamlined designs having compact, economical operation features.



SEND FOR THIS HANDY BULLETIN ON POWER TRANSMISSION CONTROL

It tells and shows how ROCKFORD CLUTCH and POWER TAKE-OFF applications are saving time, power and money in oil field equipment and a wide variety of industries. Gives capacities, dimensions and specifications.

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